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AN ALTERNATIVE APPROACH TO THE DESIGN OF ENVIRONMENTAL CONTROL SYSTEMS

by

SARIT KUMAR GAYEN

DATA VOLUME

(Supplement to Thesis submitted
in partial fulfilment of requirements for the
degree of Master of Engineering Science, December, 1983).

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APPENDIX C&D

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B

(c) TEST DATA

(C.1) MAGILL HOUSE

B

(C.1.1) DETAILS OF RECORDING AND LOGGING EQUIPMENT

Magill House

Recording and Logging Equipment

Microprocessor:	Rockwell Aim - 65, 4K Ram Version
Analogue Multiplexors:	National Semiconductor, LF 13508
Analogue Digital Convertor:	National Semiconductor, ADC1210 12 bit converter
Temperature Sensors:	National Semiconductor, LM 135 temperature Sensor (1°C accuracy)
Humidity Sensors:	Phillips (Cat. No. 2322 691 90001) 5% accuracy

Electronic interfacing and programming was designed and carried out by technical staff, Mechanical Engineering Department, University of Adelaide.

(C.1.2) HEATING AND HUMIDIFICATION

(C.1.2.1) ANALYSIS OF TEST DATA FOR A PERIOD OF 24 HOURS

HEATING & HUMIDIFICATION

REF	FRESH AIR °CDB / GM/KG DA FA	FRESH & RETURN AIR MIXTURE °CDB / GM/KG DA FRA	RETURN AIR °CDB / GM/KG OF DA RA	AIR LEAVING COMBINED HORIZONTAL SURFACE °CDB / GM/KG DA WA	SUPPLY AIR °CDB / GM/KG OF DA SA	MIXED AIR °CDB / GM/KG OF DA MA	TEMP. UPPER & LOWER LAYERS OF STORAGE °C TSU - TSL	AIR QTY THRU APPARATUS L/S Aqa	TOTAL AIR QTY L/S Aqt	BY-PASS FACTOR, AUTOMATIC BF3	AIRCOND. LOAD WATTS L	THERMAL ENERGY SUPPLY BY THE CONVERTER WATTS Qt	LOSS FROM APPARATUS WATTS la
60602	13·5 7·6	21·1 10·8	23·0 11·6	22·0 12·0	39·0 12·5	29·6 11·6	43 39	288	600	0·52	7655	7940	380
60603	13·5 7·6	21·1 10·8	23·0 11·6	22·0 12·0	39·0 12·5	29·6 11·6	43 39	288	600	0·52	7655	7940	380
60604	13·5 7·6	21·1 10·8	23·0 11·6	22·0 12·0	39·0 12·5	29·6 11·6	42·9 38·9	288	600	0·52	7655	7940	380
60605	11·0 7·5	19·0 10·3	21·0 11·0	20·0 11·5	39·0 12·0	28·6 11·0	42·6 38·6	288	600	0·52	8381	7940	414
60606	11·4 7·5	19·0 10·3	20·9 11·0	20·0 11·4	38·6 11·8	29·4 11·0	42·0 38·0	318	600	0·47	8910	7940	462
60607	11·9 7·4	19·0 9·8	20·9 10·4	19·9 10·8	38·0 11·2	29·0 10·5	41·6 37·6	318	600	0·47	8585	7940	402
60608	13·0 7·5	19·0 9·8	20·5 10·4	19·9 10·7	37·6 11·1	28·3 10·5	41·5 37·5	300	600	0·50	7866	7940	401
60609	13·5 7·3	19·5 9·7	21·0 10·3	20·4 10·6	37·0 11·0	29·1 10·4	41·1 37·1	330	600	0·45	8217	7940	396
60610	14·0 7·3	20·4 9·7	22·0 10·3	21·2 10·5	36·7 11·0	27·1 10·2	41·9 37·9	246	600	0·59	5771	7940	295
60611	16·0 6·6	22·0 9·4	23·5 10·1	22·6 10·2	37·8 11·0	28·0 10·0	42·8 38·8	228	600	0·62	5486	7940	205
60612	16·7 6·8	22·5 9·2	24·0 9·8	23·0 10·6	38·6 11·0	28·5 9·9	43·1 39·1	222	600	0·63	5488	6367	202
60613	17·5 7·0	23·5 9·4	25·0 10·0	23·9 10·9	38·8 11·1	28·1 9·9	43·2 39·2	180	600	0·70	4273	4775	173
60614	18·1 8·2	24·1 9·8	25·6 10·2	24·5 11·0	38·7 11·3	28·3 10·2	43·2 39·2	174	600	0·71	3831	3916	146
60615	18·1 8·2	24·1 9·8	25·6 10·2	24·5 11·0	38·7 11·3	28·3 10·2	43·1 39·1	174	600	0·71	3831	3916	146
60616	18·5 9·2	24·5 10·0	26·0 10·2	24·9 11·2	38·7 11·3	28·5 10·4	43·1 39·1	168	600	0·72	3528	3582	140
60617	18·5 9·2	24·5 10·0	26·0 10·2	24·9 11·0	38·7 11·3	28·5 10·4	43·0 39·0	168	600	0·72	3528	3582	140
60618	14·0 7·8	21·6 9·4	23·5 9·8	22·1 10·7	38·7 11·3	26·2 9·8	43·2 39·2	162	600	0·73	4006	4620	195
60619	12·2 7·4	19·8 9·4	21·7 10·0	20·7 10·8	39·0 11·1	27·9 10·1	43·2 39·2	252	600	0·58	7091	7393	302
60620	12·2 7·4	19·8 9·4	21·7 10·0	20·7 10·8	39·0 11·1	27·9 10·1	43·2 39·2	252	600	0·58	7091	7393	302
60621	12·5 7·6	18·9 9·9	20·5 10·4	19·8 11·2	39·0 11·4	27·7 10·6	43·3 39·3	264	600	0·56	7587	7940	316
60622	9·0 6·4	18·2 9·6	20·5 10·4	19·3 10·7	39·2 11·2	29·5 10·5	42·4 38·4	324	600	0·46	9720	7940	359
60623	8·0 5·6	18·0 9·6	20·5 10·6	19·2 10·6	38·4 11·1	30·6 10·5	41·0 37·0	372	600	0·38	10781	7940	535
60624	8·5 6·0	18·5 10·0	21·0 11·0	19·8 10·8	37·0 11·2	30·7 10·8	39·8 35·8	396	600	0·34	10217	7940	570
70601	12·0 7·6	19·2 10·0	21·0 10·6	20·0 10·5	35·6 10·9	28·2 10·5	39·9 35·9	330	600	0·45	7385	7940	396

(C.1.2.2) PSYCHROMETRIC CHARTS FOR THIS PERIOD OF 24 HOURS

AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING & HEATING, INC.

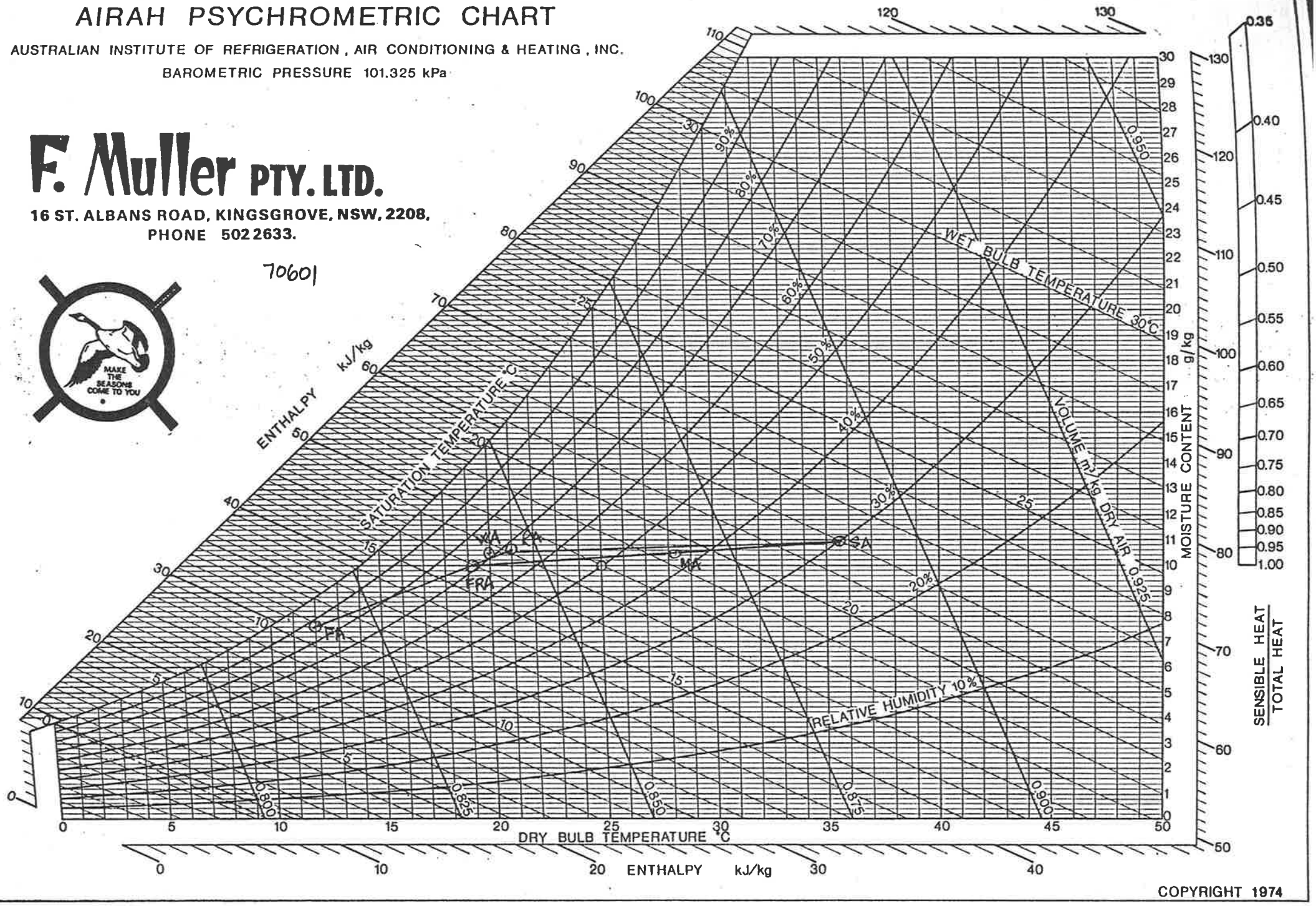
BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

16 ST. ALBANS ROAD, KINGSGROVE, NSW, 2208.

PHONE 502 2633.

70601



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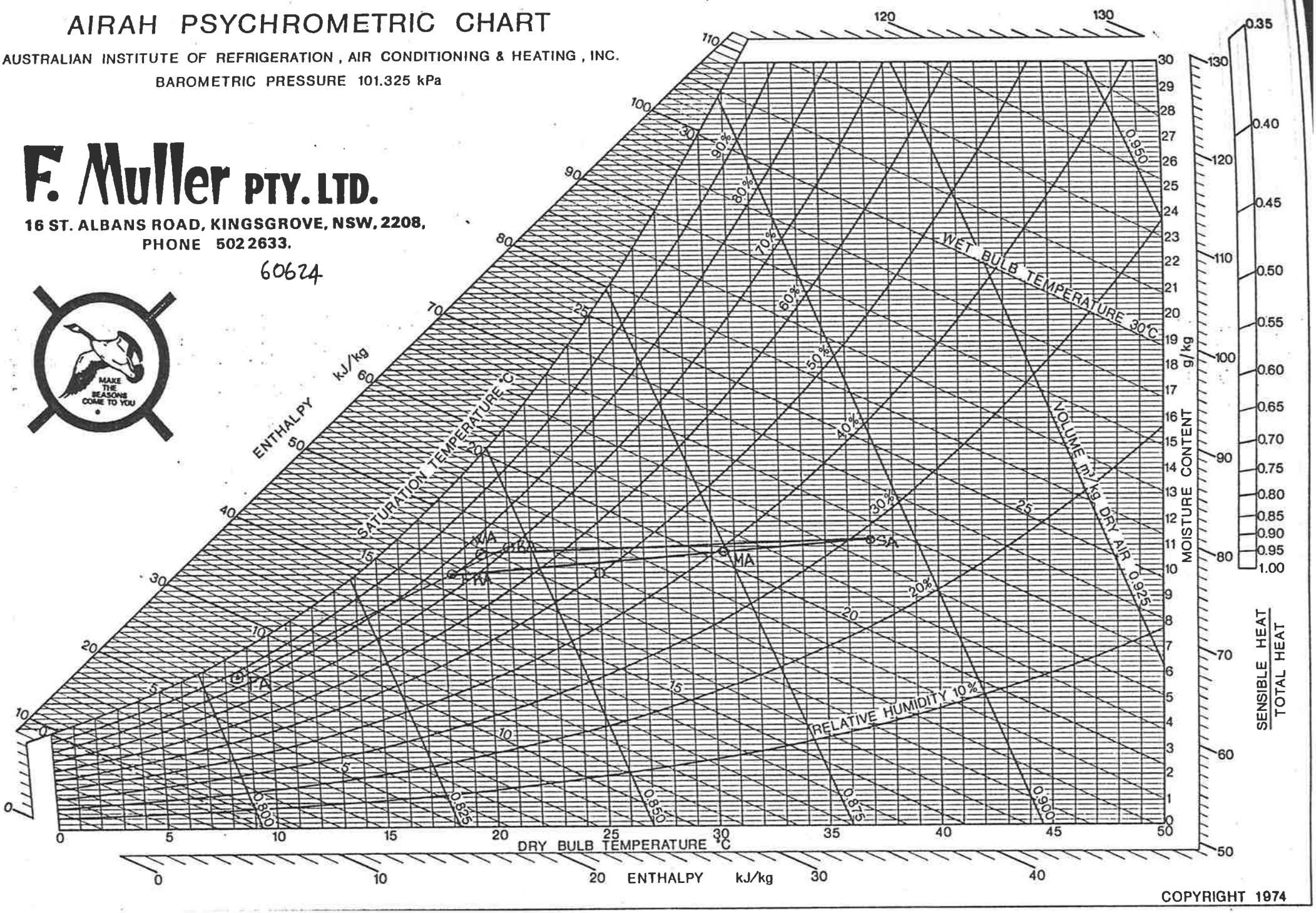

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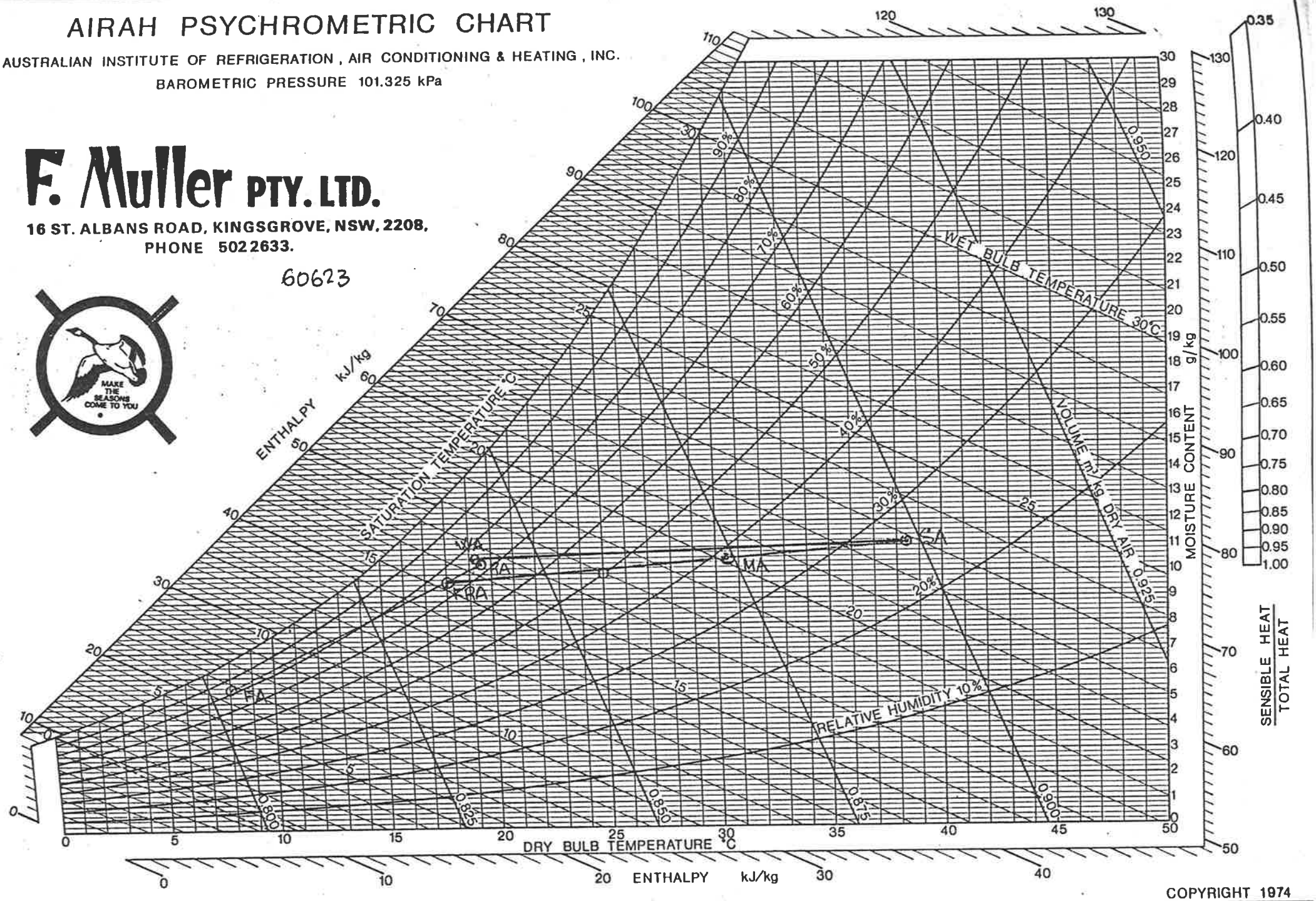

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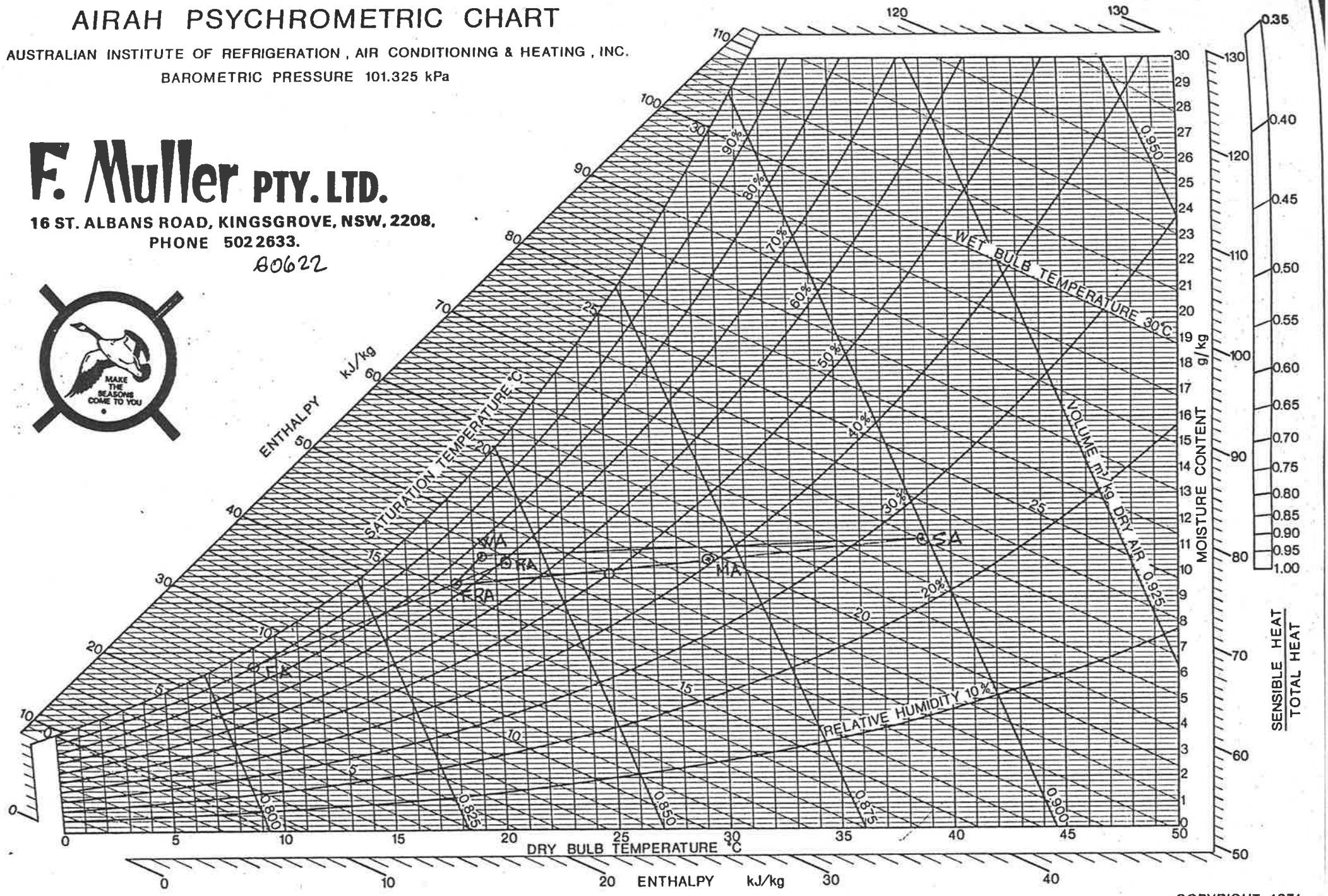

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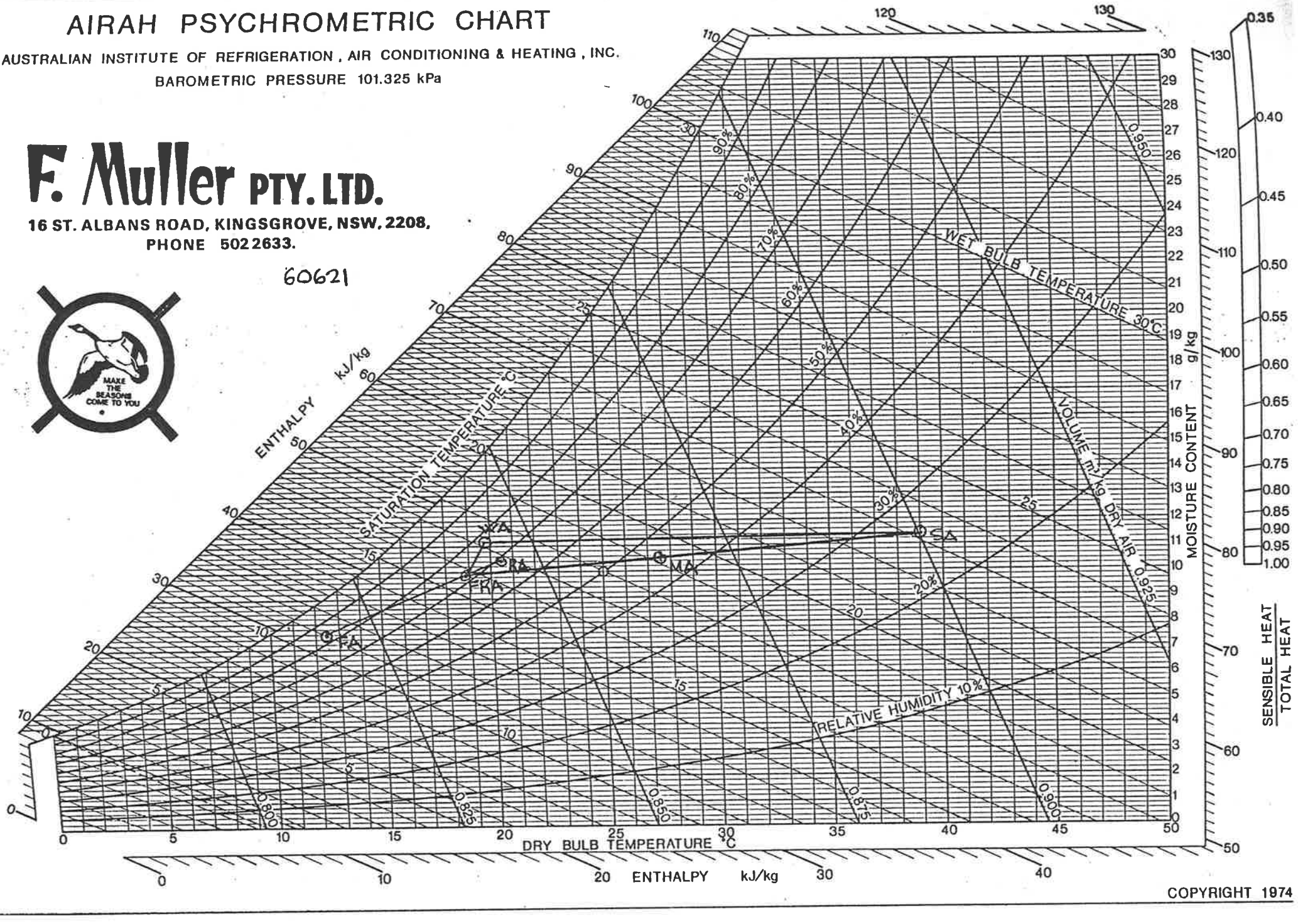

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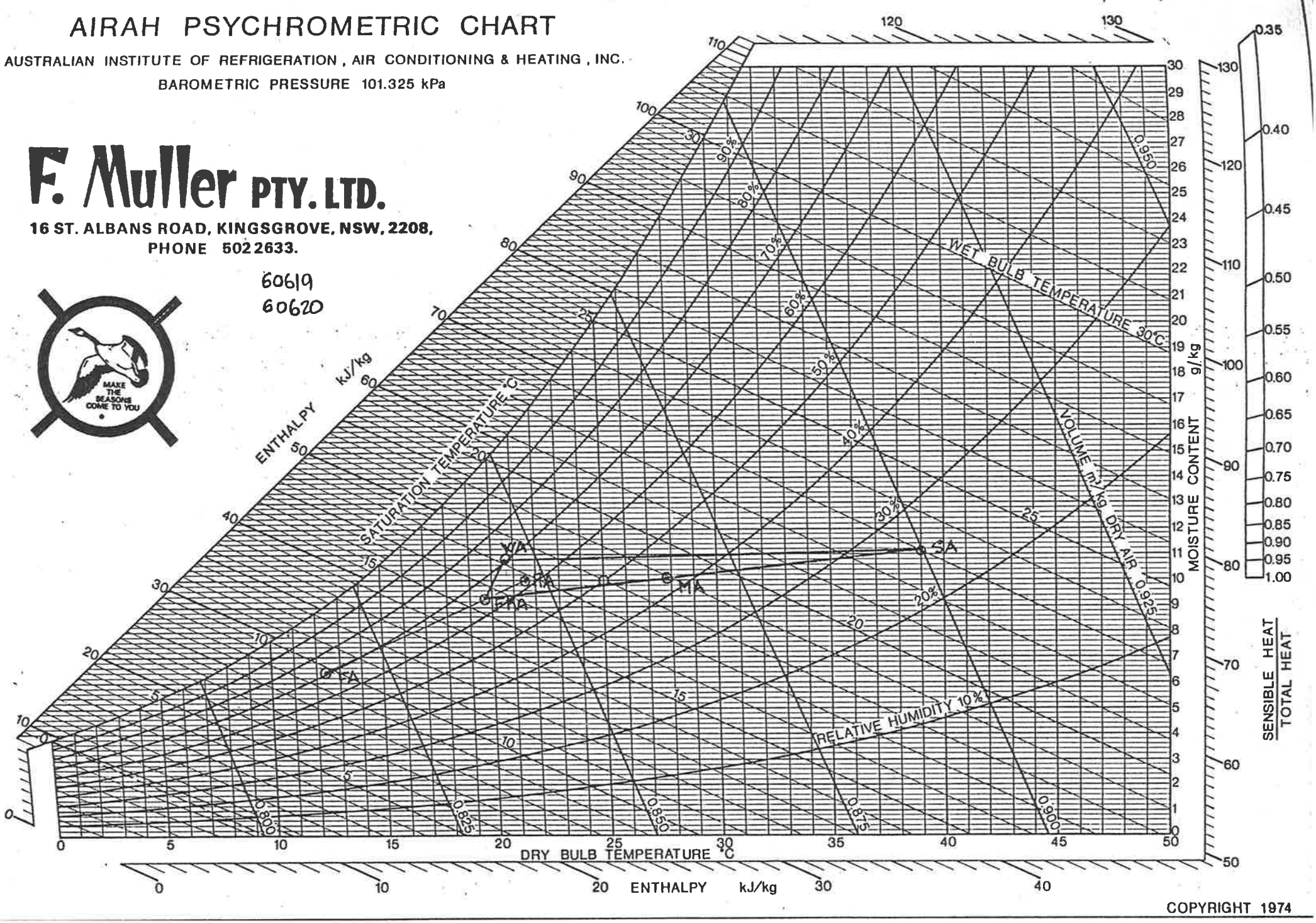

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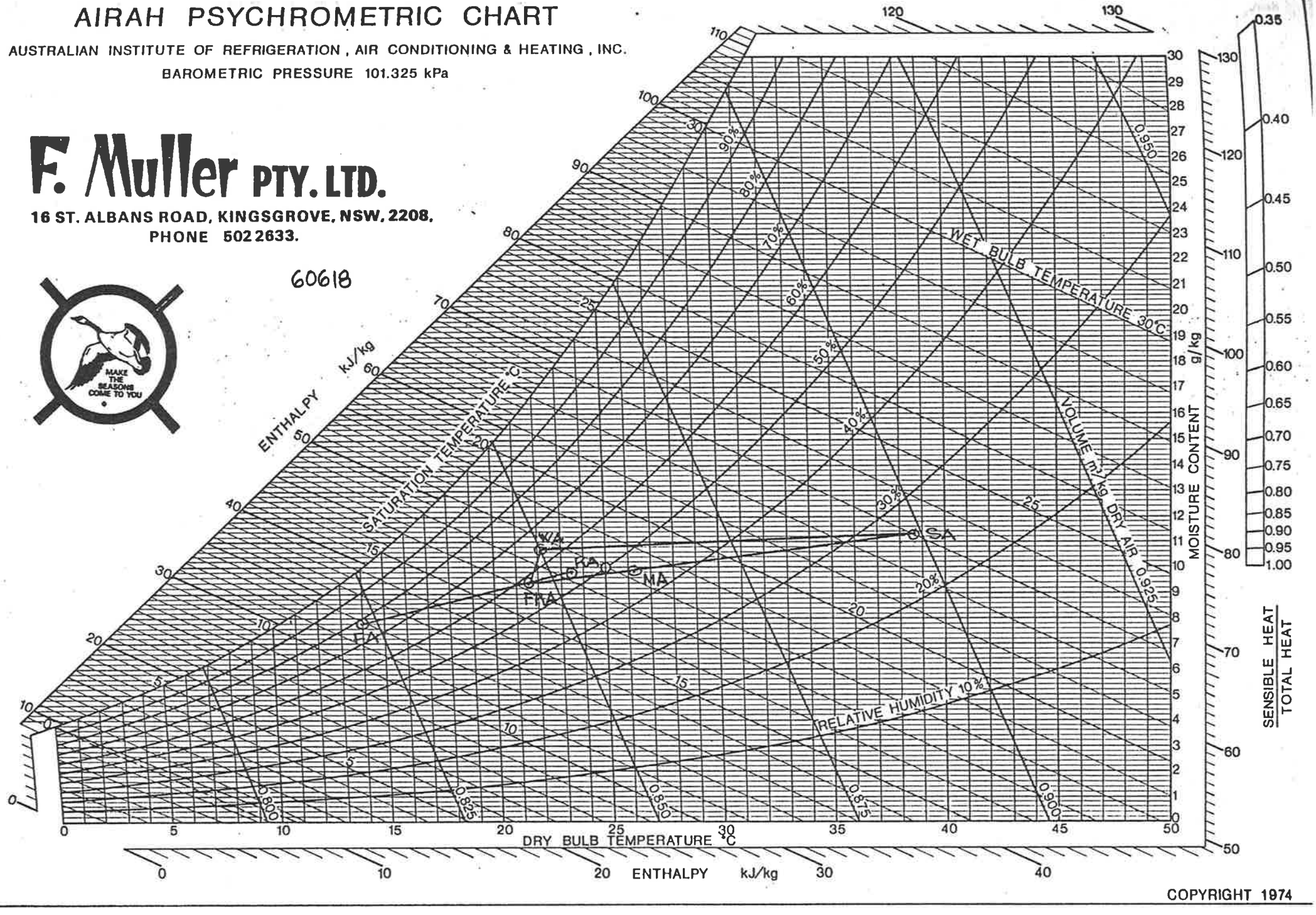

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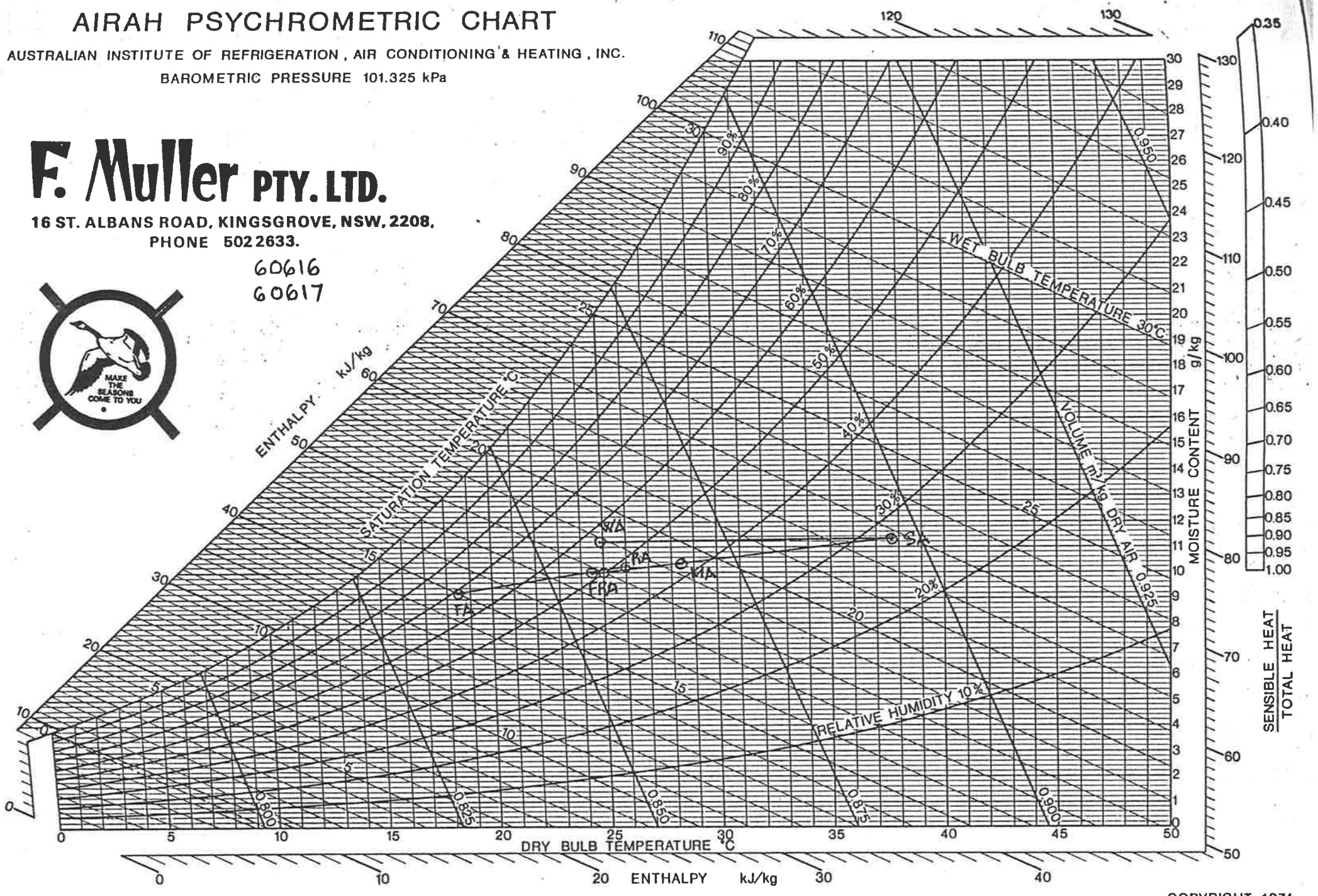

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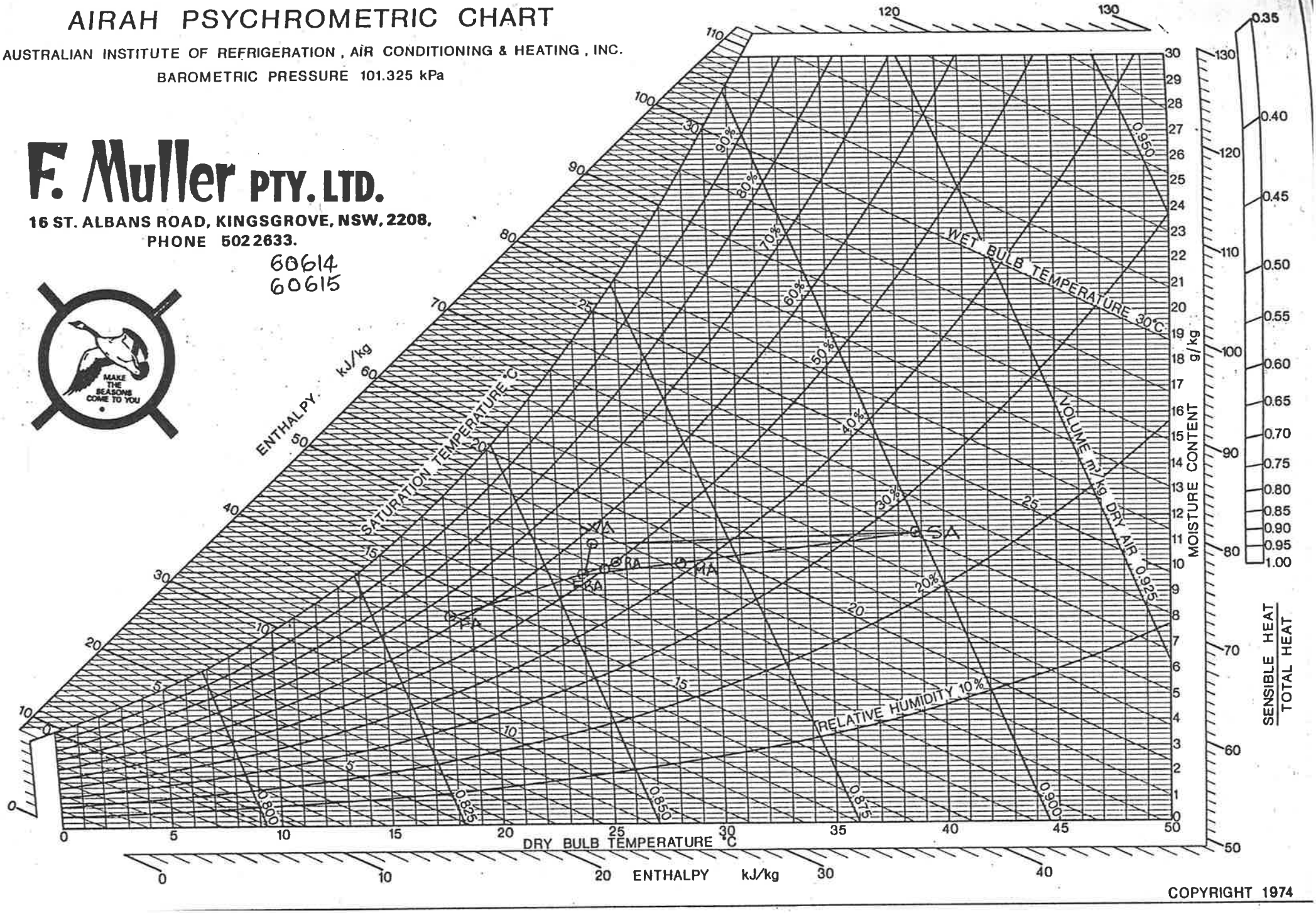

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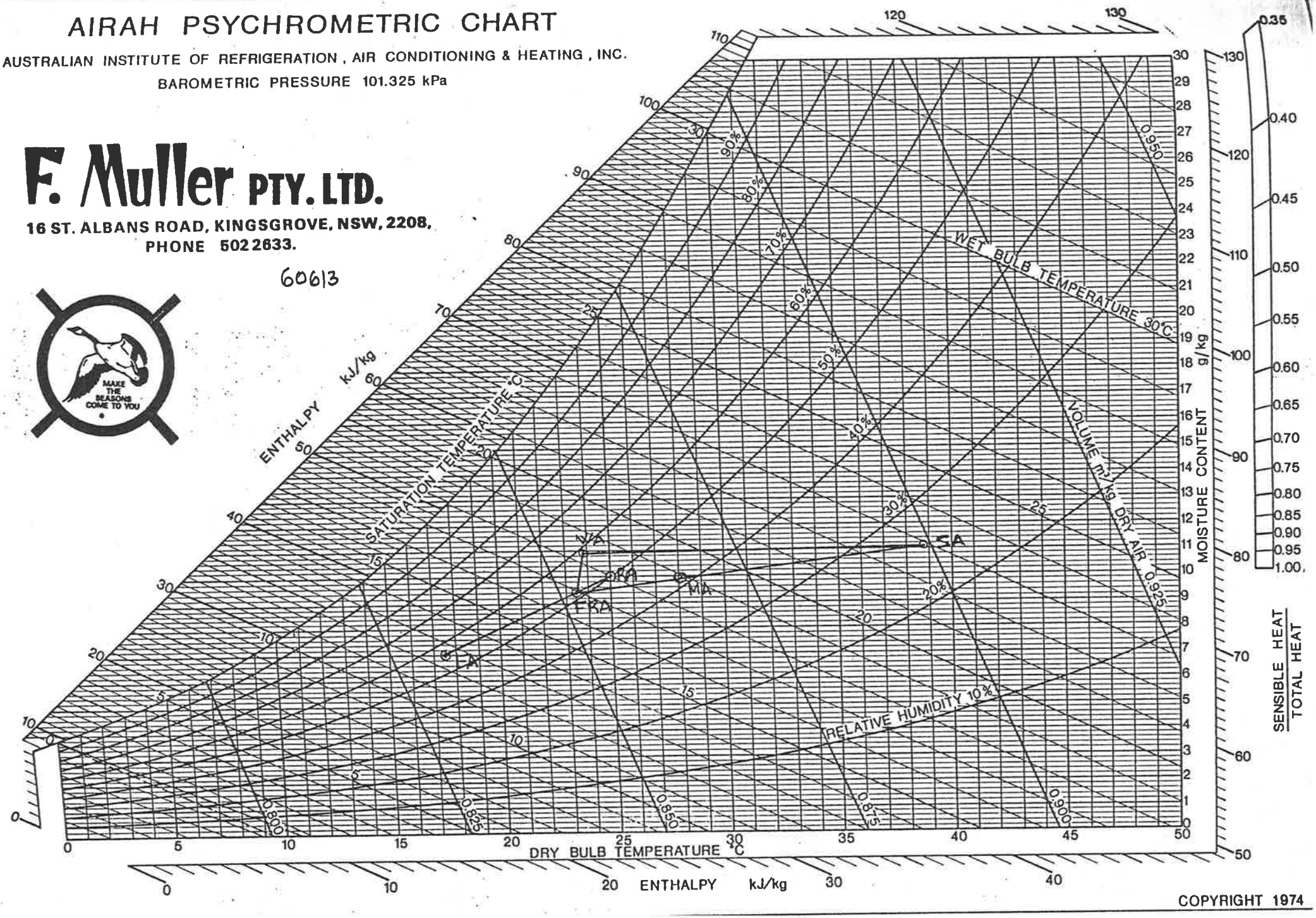

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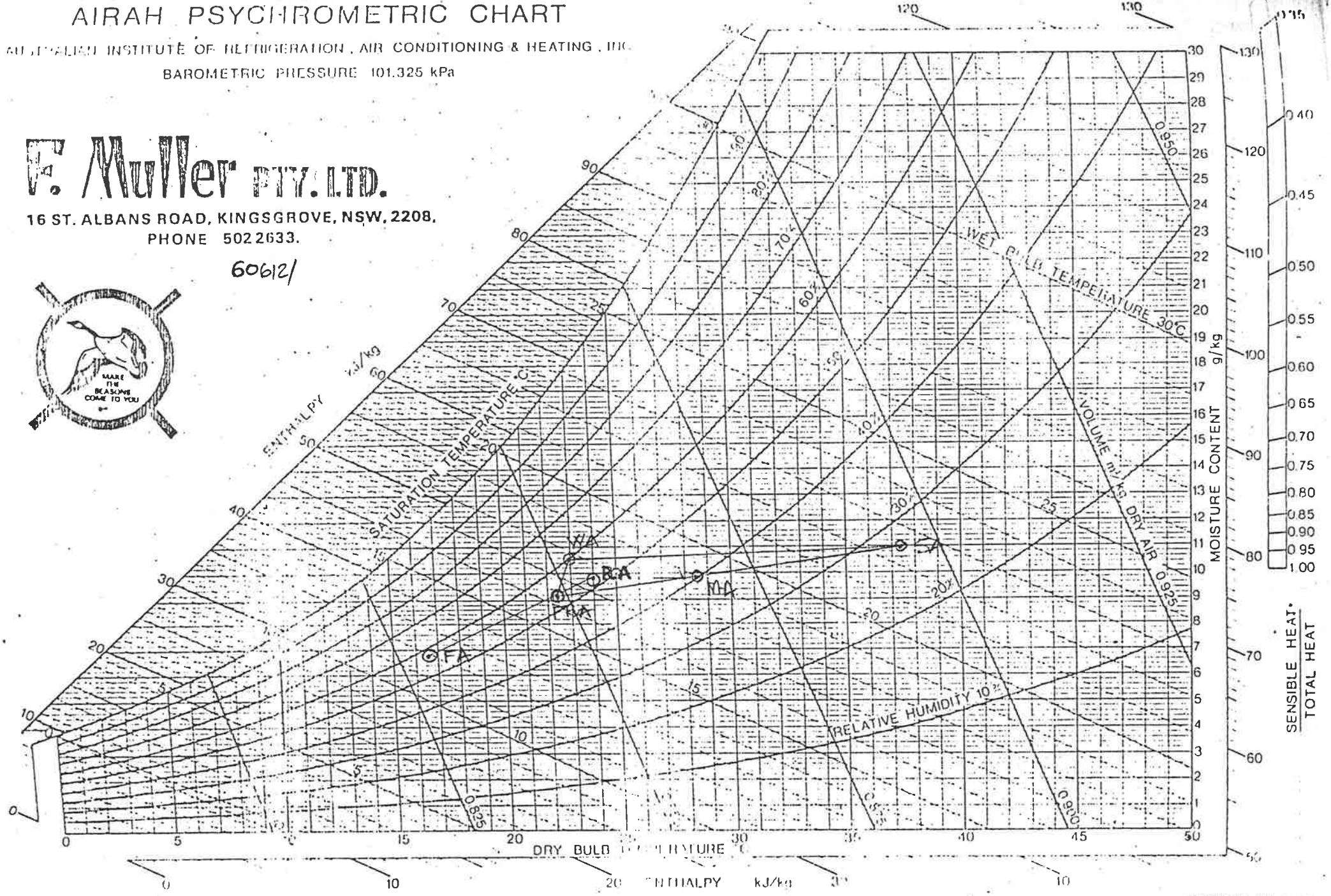

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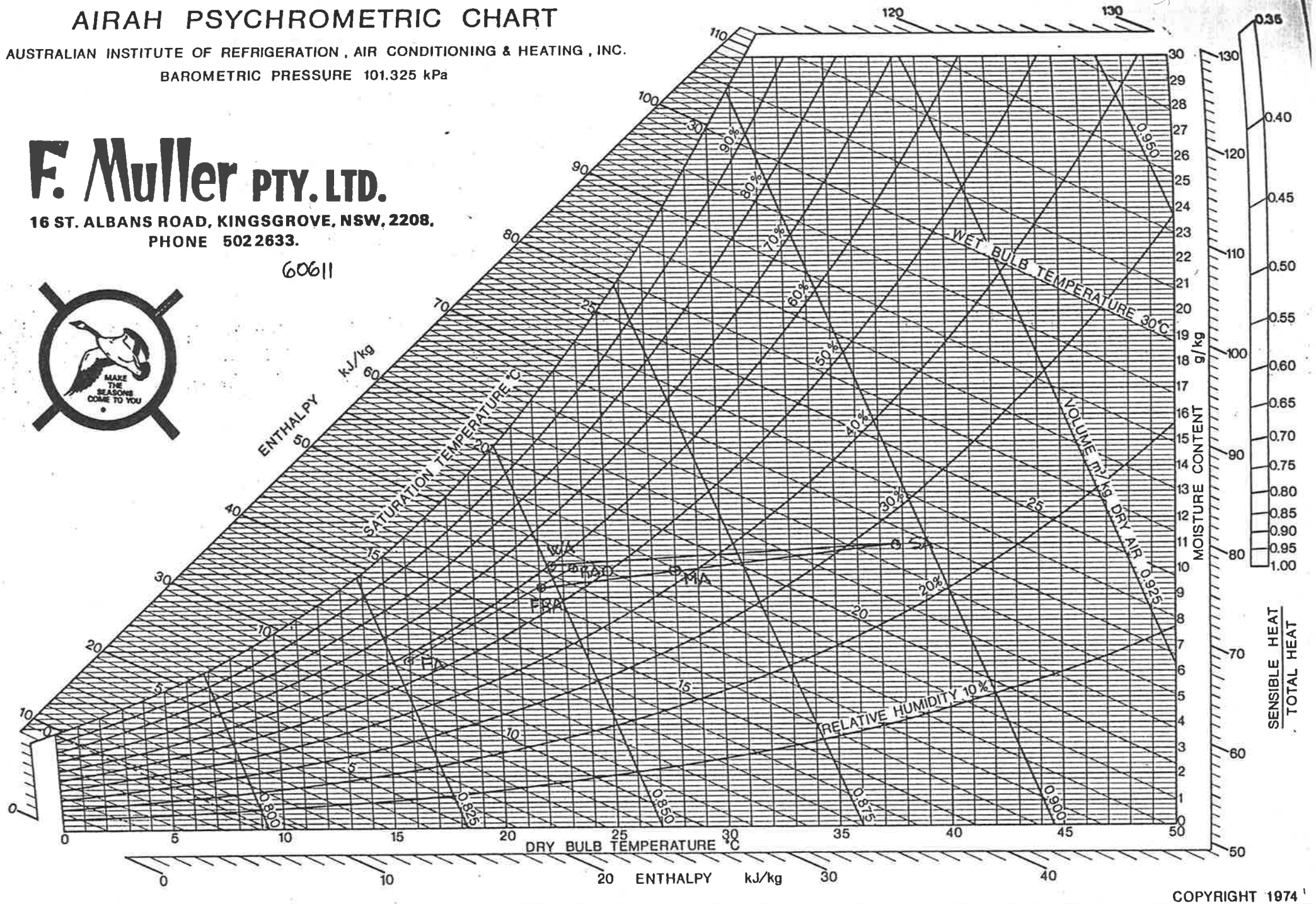

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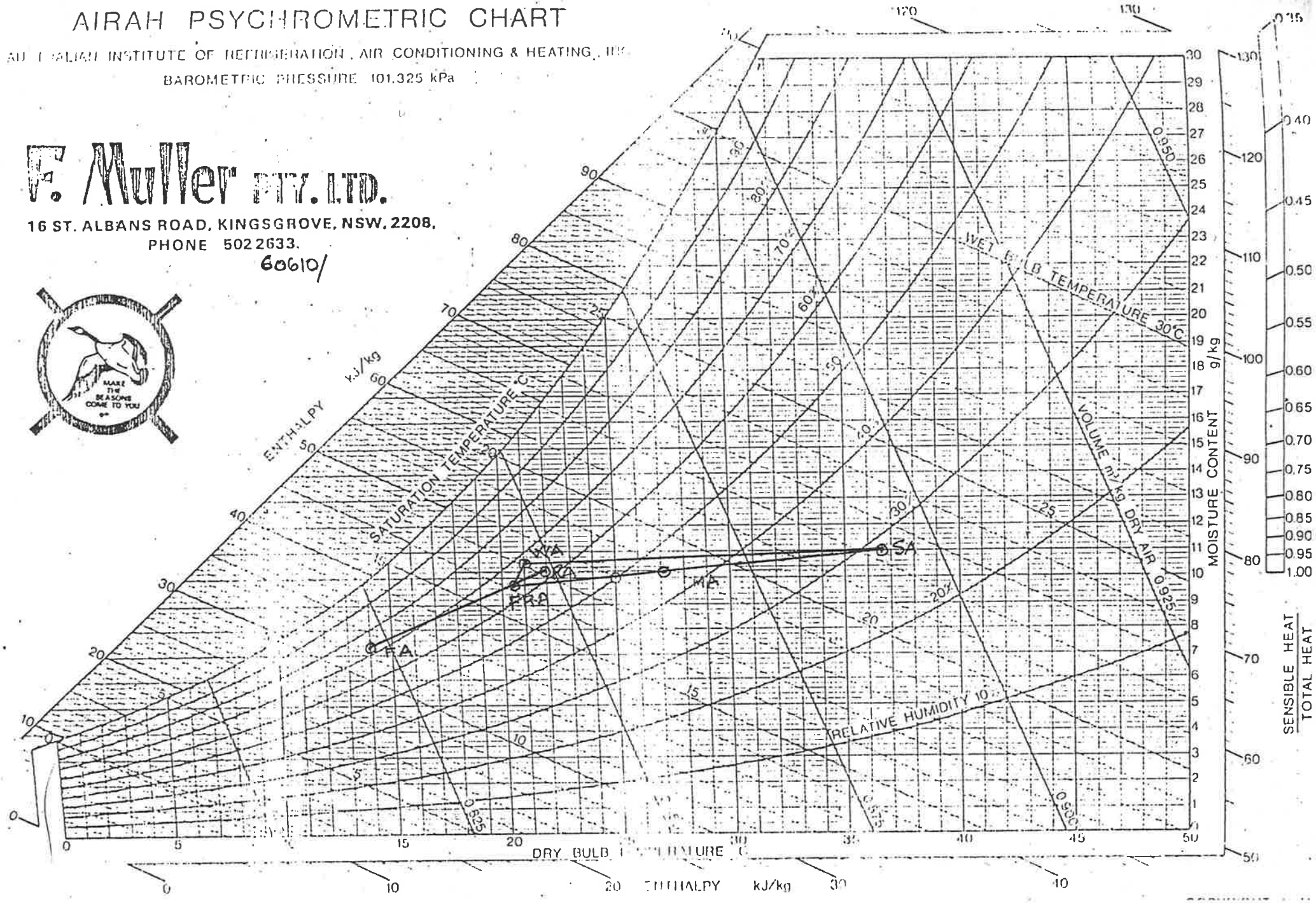

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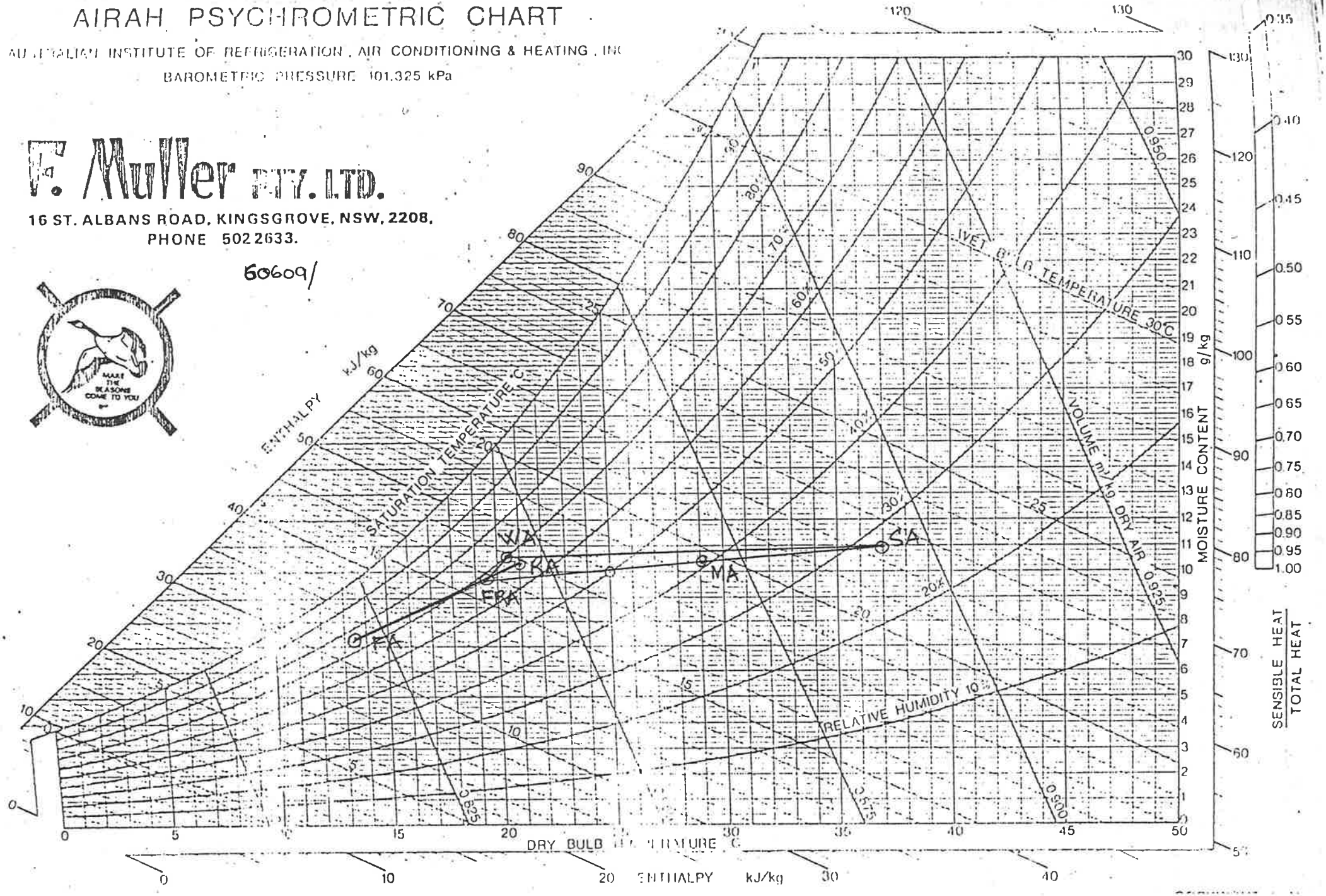

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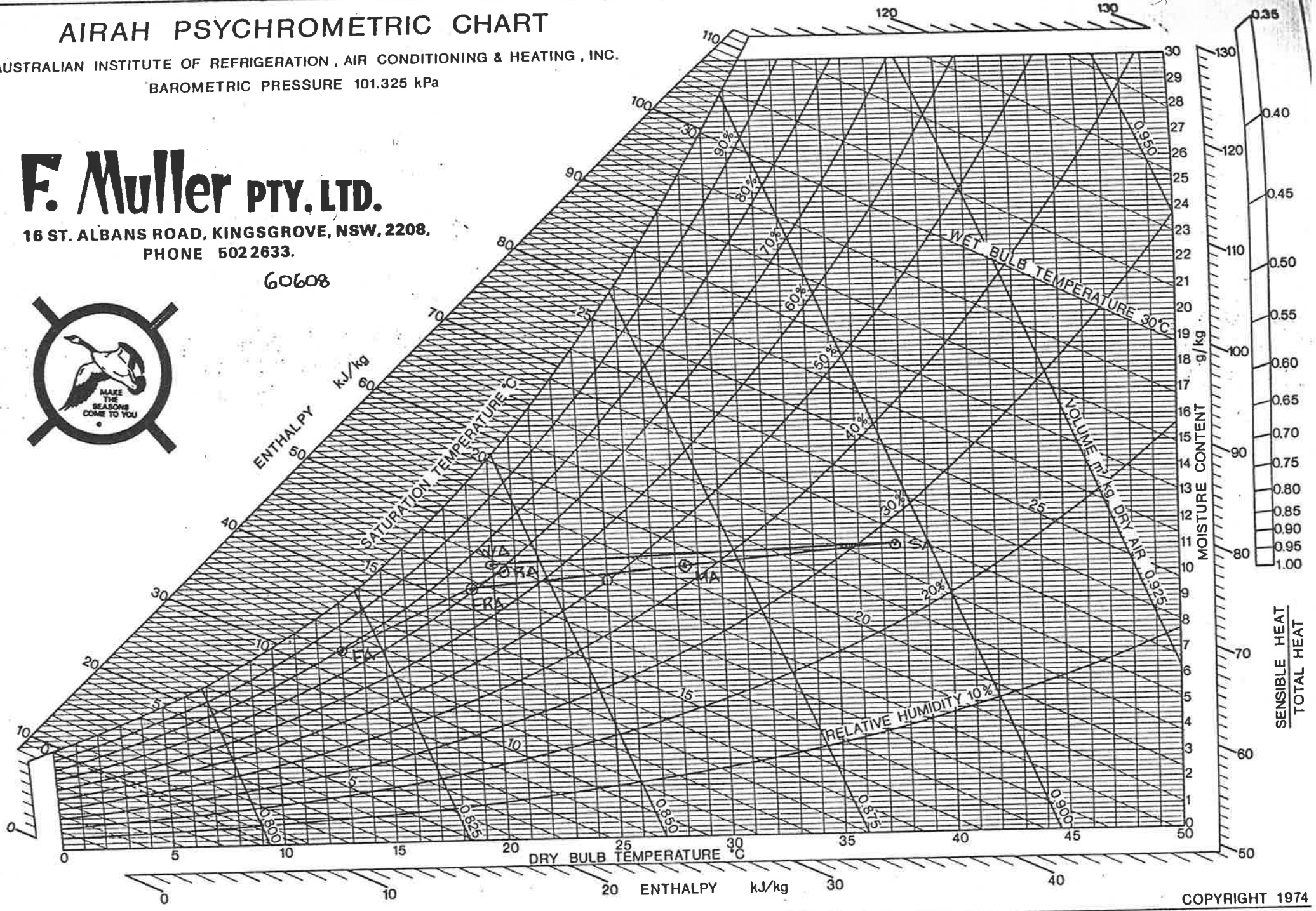

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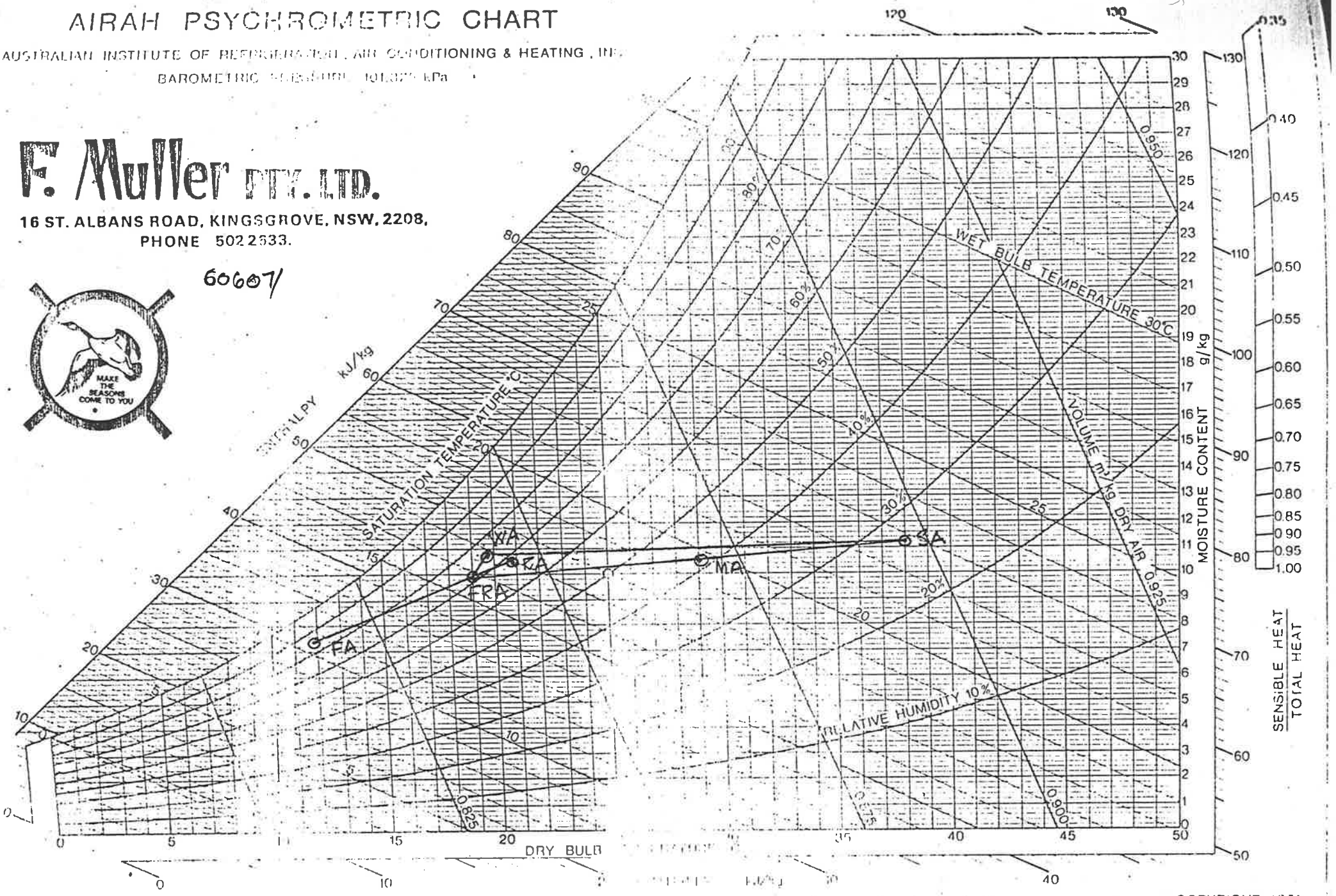

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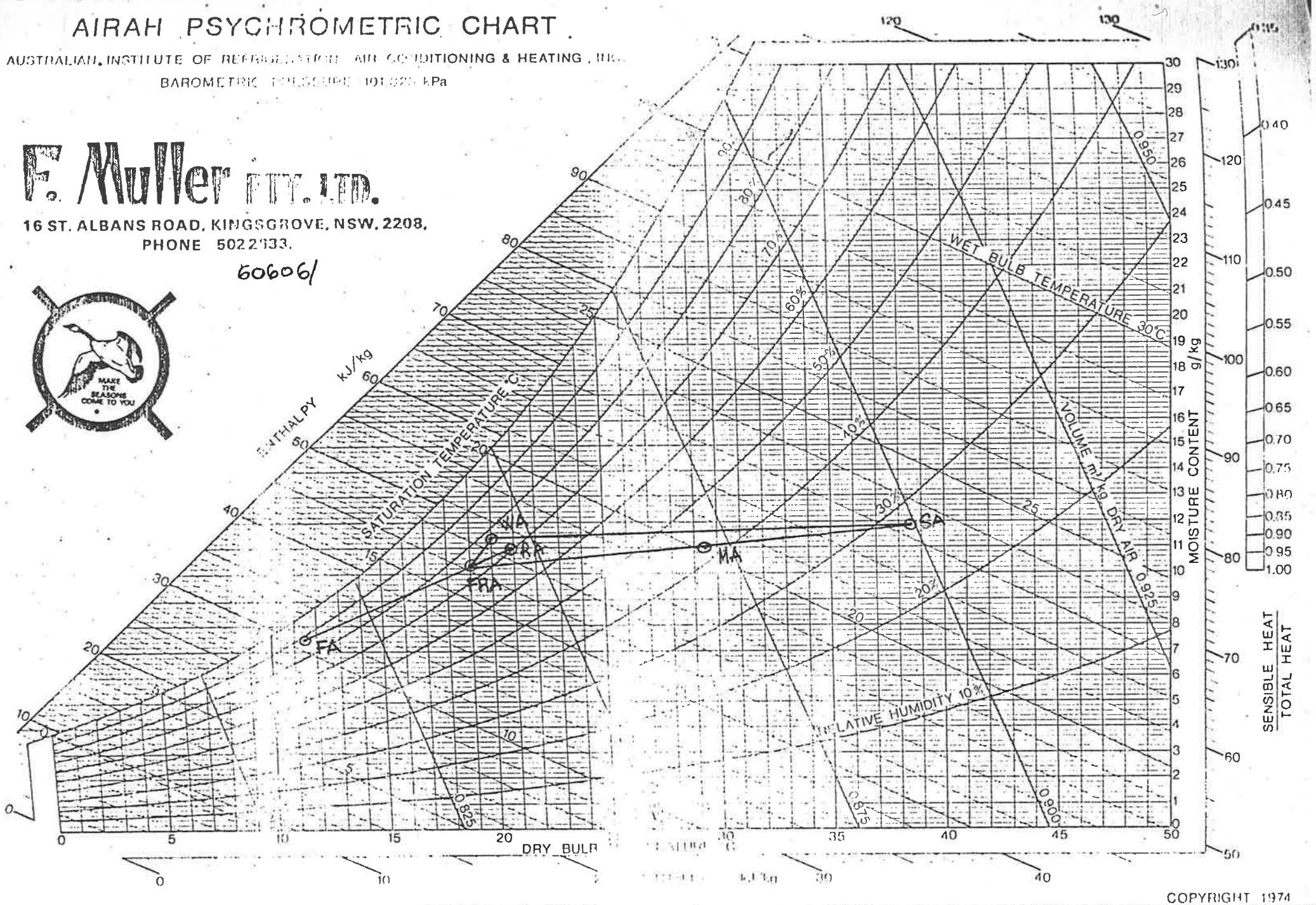

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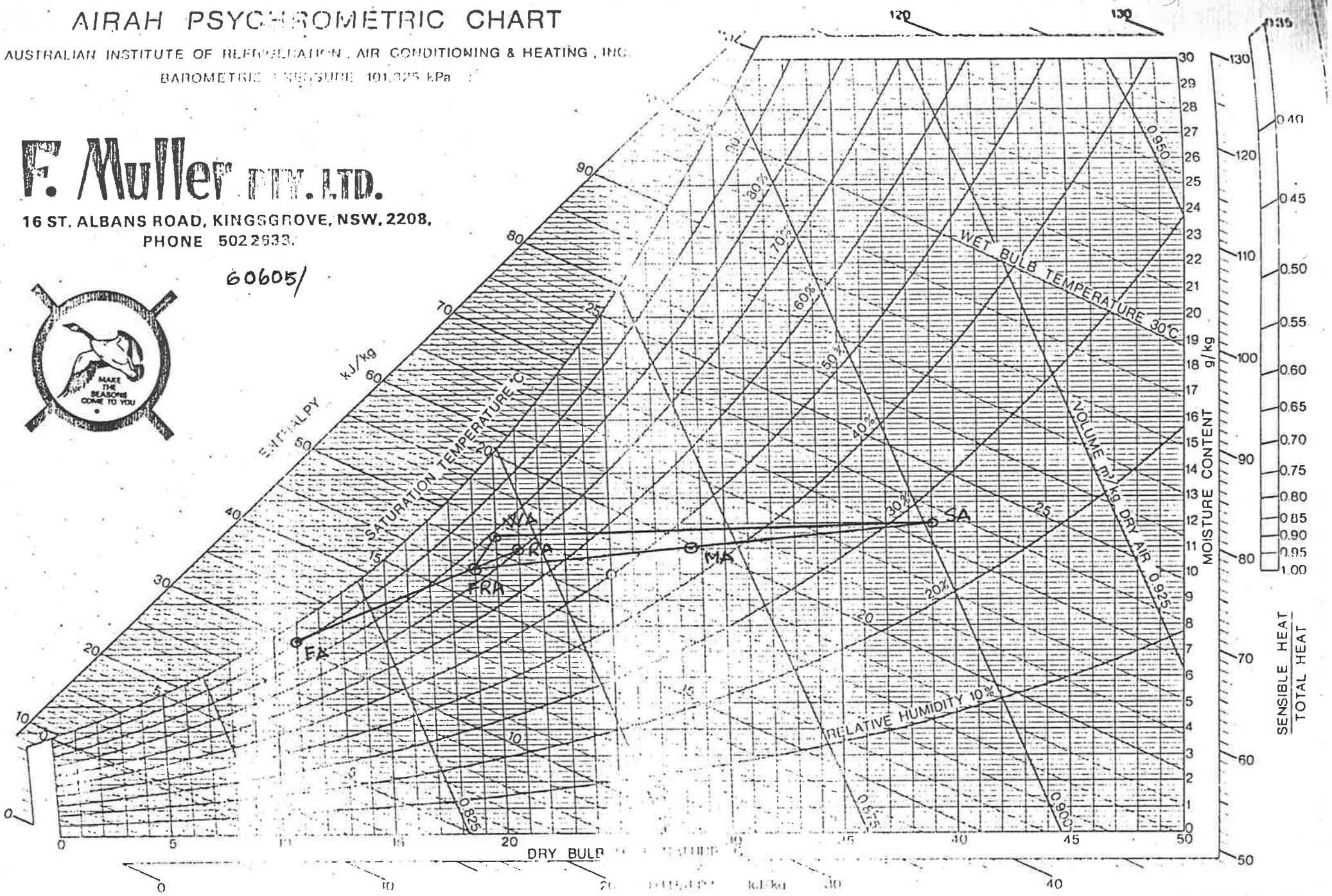

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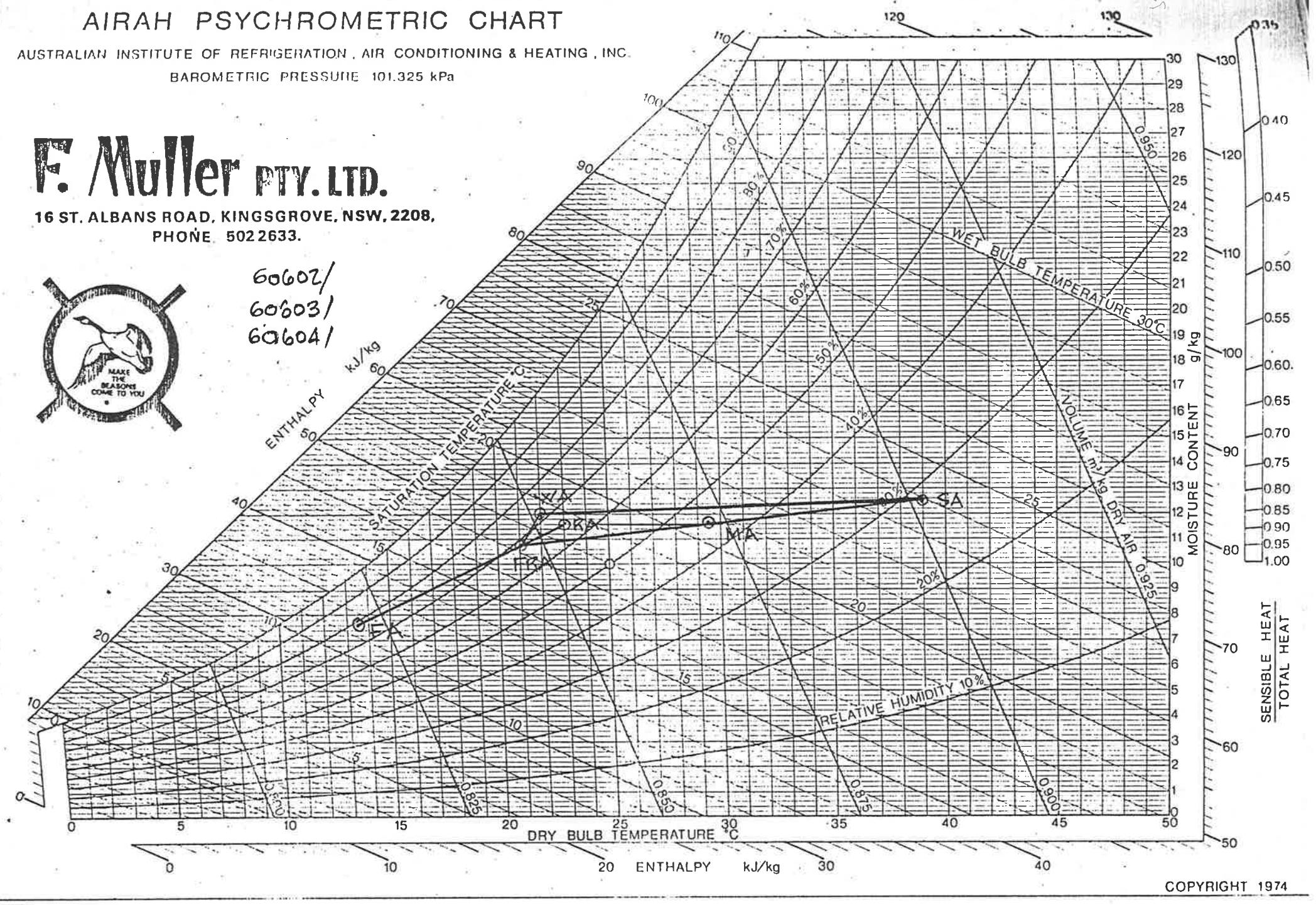
60602/
60603/
60604/



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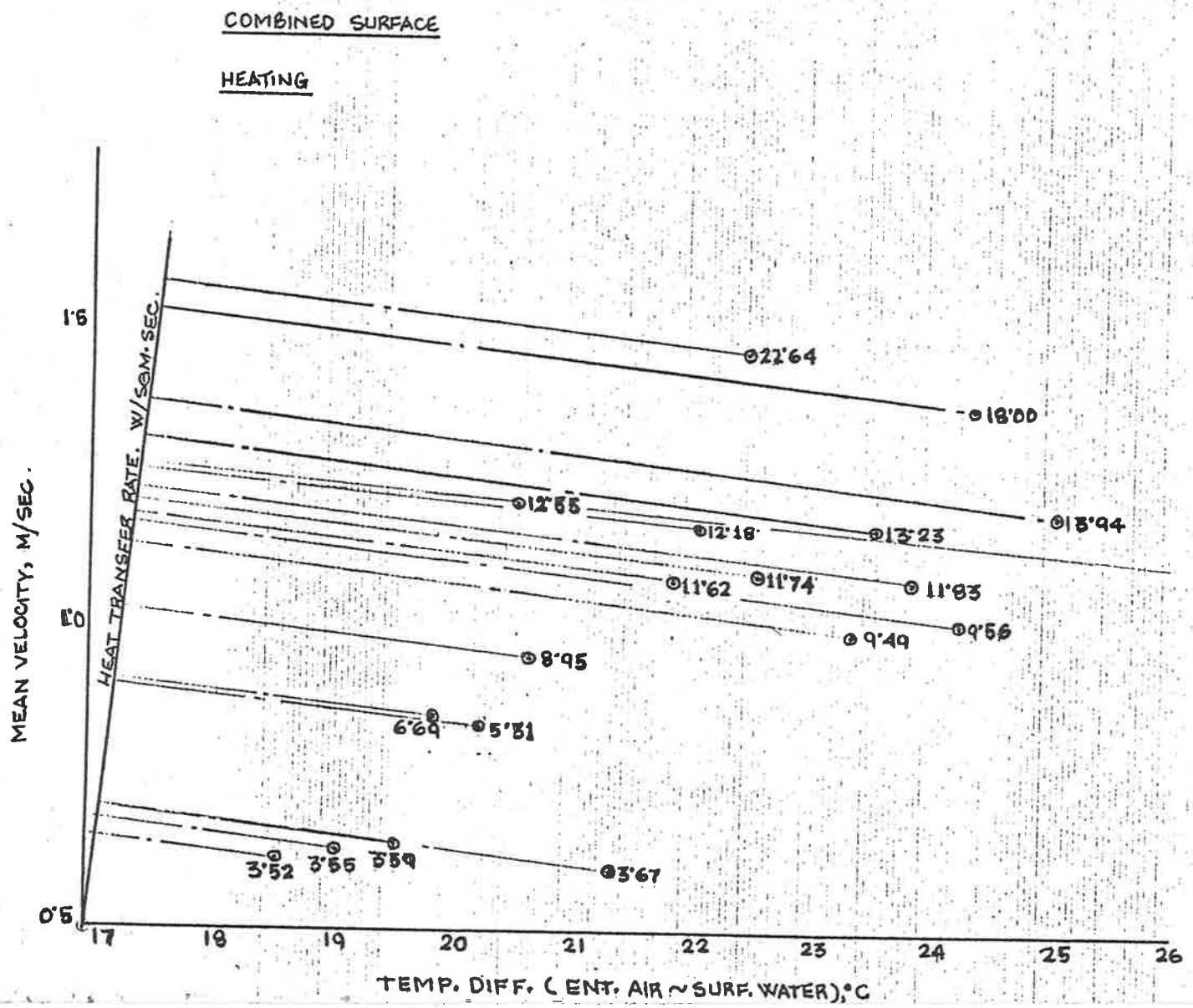
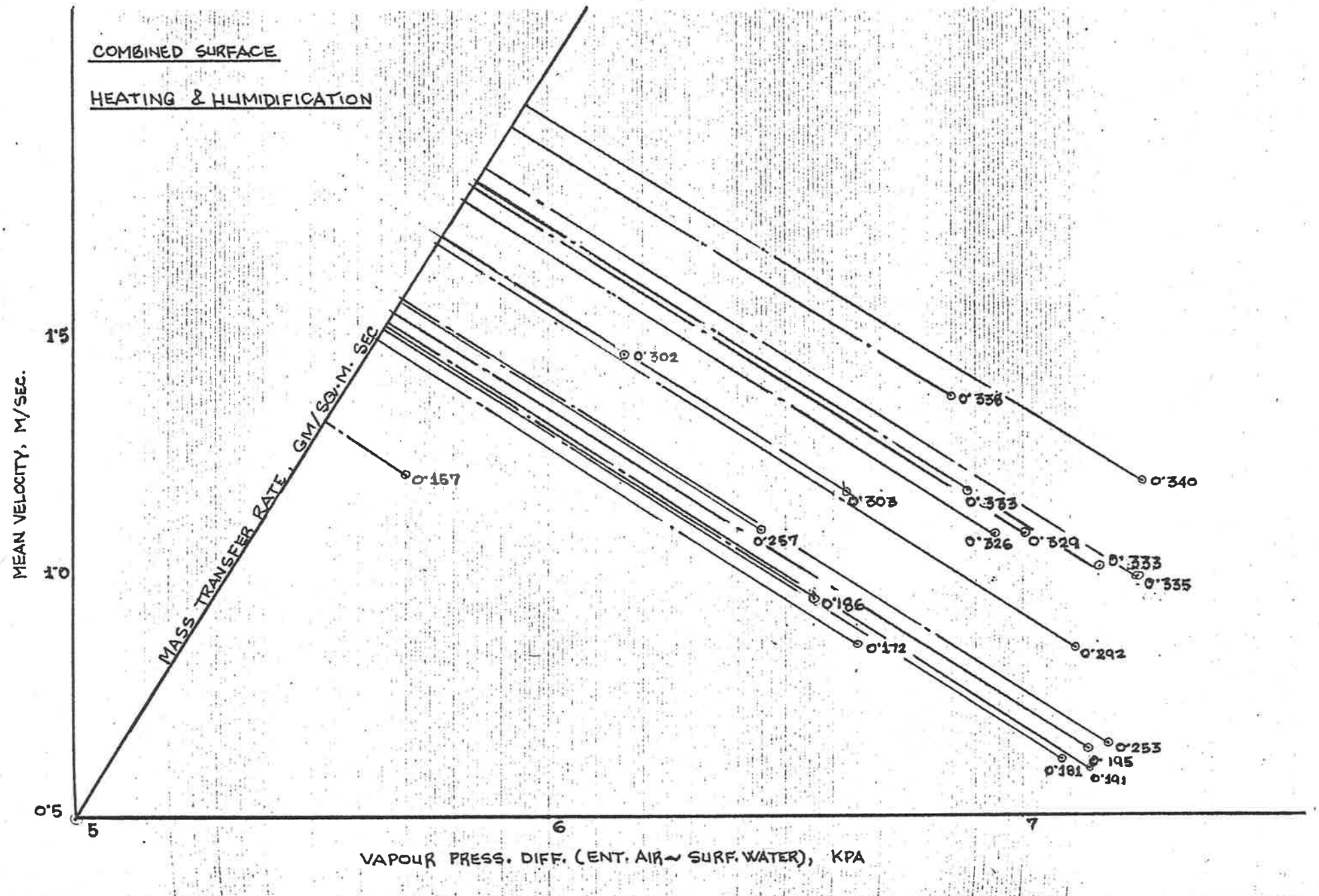
(C.1.2.3) HEAT AND MASS TRANSFER FOR COMBINED SURFACE

HEATING & HUMIDIFICATION

COMBINED SURFACE

AIR QTY L/S	AIR ON °CDB	AIR ON GM/KG·DA	AIR OFF °CDB	AIR OFF GM/KG DA	WATER SURF. TEMP °C	AIR VELOCITY M/SEC	AIR MASS FLOW KG DA/SEC	LOG MEAN TEMP. DIFF °C	SENSIBLE ENERGY TRANSFER WATTS	LENGTH OF COMBINED SURFACE M	COMBINED SURFACE AREA SQ M	HEAT TRANSFER W/SQM.°C	TEMP DIFF (ENT. AIR ~ WAT. SURF) °C	VAP PRESS. DIFF KPA	MASS TRANSFER GM/SQM·SEC
288	21·1	10·8	22·0	12·0	43·0	1·09	0·3399	21·40	311	2·1	1·25	11·62	21·9	6·938	0·326
288	19·0	10·3	20·0	11·5	43·0	1·09	0·3429	23·40	346	2·1	1·25	11·83	23·9	7·014	0·329
318	19·0	10·3	20·0	11·4	42·6	1·18	0·3784	23·10	382	2·1	1·25	13·23	23·6	6·881	0·333
318	19·0	9·8	19·9	10·8	42·0	1·18	0·3785	22·54	343	2·1	1·25	12·18	22·1	6·637	0·303
300	19·0	9·8	19·9	10·7	41·6	1·10	0·3570	22·08	324	2·1	1·25	11·74	22·6	6·449	0·257
246	20·4	9·7	21·2	10·5	41·1	0·96	0·2914	21·09	236	2·1	1·25	8·95	20·7	6·559	0·186
228	22·0	9·4	22·6	10·2	41·9	0·86	0·2688	19·60	164	2·1	1·25	6·69	19·9	6·650	0·172
222	22·5	9·2	23·0	10·6	42·8	0·85	0·2614	20·05	133	2·1	1·25	5·31	20·3	7·111	0·292
180	23·5	9·4	23·9	10·9	43·1	0·65	0·2111	19·40	87	2·1	1·25	3·59	19·6	7·180	0·253
174	24·1	9·8	24·5	11·0	43·2	0·64	0·2036	18·48	82	2·1	1·25	3·55	19·1	7·140	0·195
168	24·5	10·0	24·9	11·2	43·1	0·62	0·1962	18·40	81	2·1	1·25	3·52	18·6	7·087	0·181
162	21·6	9·4	22·1	10·7	43·0	0·60	0·1912	21·10	117	2·1	1·25	3·67	21·4	7·143	0·191
252	19·8	9·4	20·7	10·8	43·2	1·00	0·2994	22·95	272	2·1	1·25	9·49	23·4	7·243	0·335
264	18·9	9·9	19·8	11·2	43·2	1·02	0·3201	23·84	285	2·1	1·25	9·56	24·3	7·160	0·333
324	18·2	9·6	19·3	10·7	43·3	1·20	0·3868	24·55	428	2·1	1·25	13·94	25·1	7·252	0·340
396	18·5	10·0	19·8	10·8	41·0	1·47	0·4719	21·84	618	2·1	1·25	22·64	22·5	6·159	0·302
372	18·0	9·6	19·2	10·6	42·4	1·38	0·4446	23·80	536	2·1	1·25	18·00	24·4	6·849	0·338
330	19·2	10·0	20·0	10·5	39·8	1·22	0·3924	20·20	317	2·1	1·25	12·55	20·6	5·700	0·157


COMBINED SURFACE
HEATING
HEAT TRANSFER RATE, W/SQM. SEC.
MEAN VELOCITY, M/SEC.
1·5
1·0
0·5
22·64
18·00
15·94
13·23
12·55
12·18
11·93
11·74
11·62
9·56
9·49
8·95
6·69
5·51
3·67
3·59
3·55
3·52
17
18
19
20
21
22
23
24
25
26
TEMP. DIFF. (ENT. AIR ~ SURF. WATER), °C


COMBINED SURFACE
HEATING & HUMIDIFICATION
MEAN VELOCITY, M/SEC.
1·5
1·0
0·5
MASS TRANSFER RATE, GM/SQ.M. SEC
0·157
0·302
0·338
0·340
0·303
0·333
0·326
0·329
0·333
0·335
0·257
0·186
0·172
0·292
0·253
0·195
0·181
0·191
5
6
7
VAPOUR PRESS. DIFF. (ENT. AIR ~ SURF. WATER), KPA

HEATING & HUMIDIFICATION

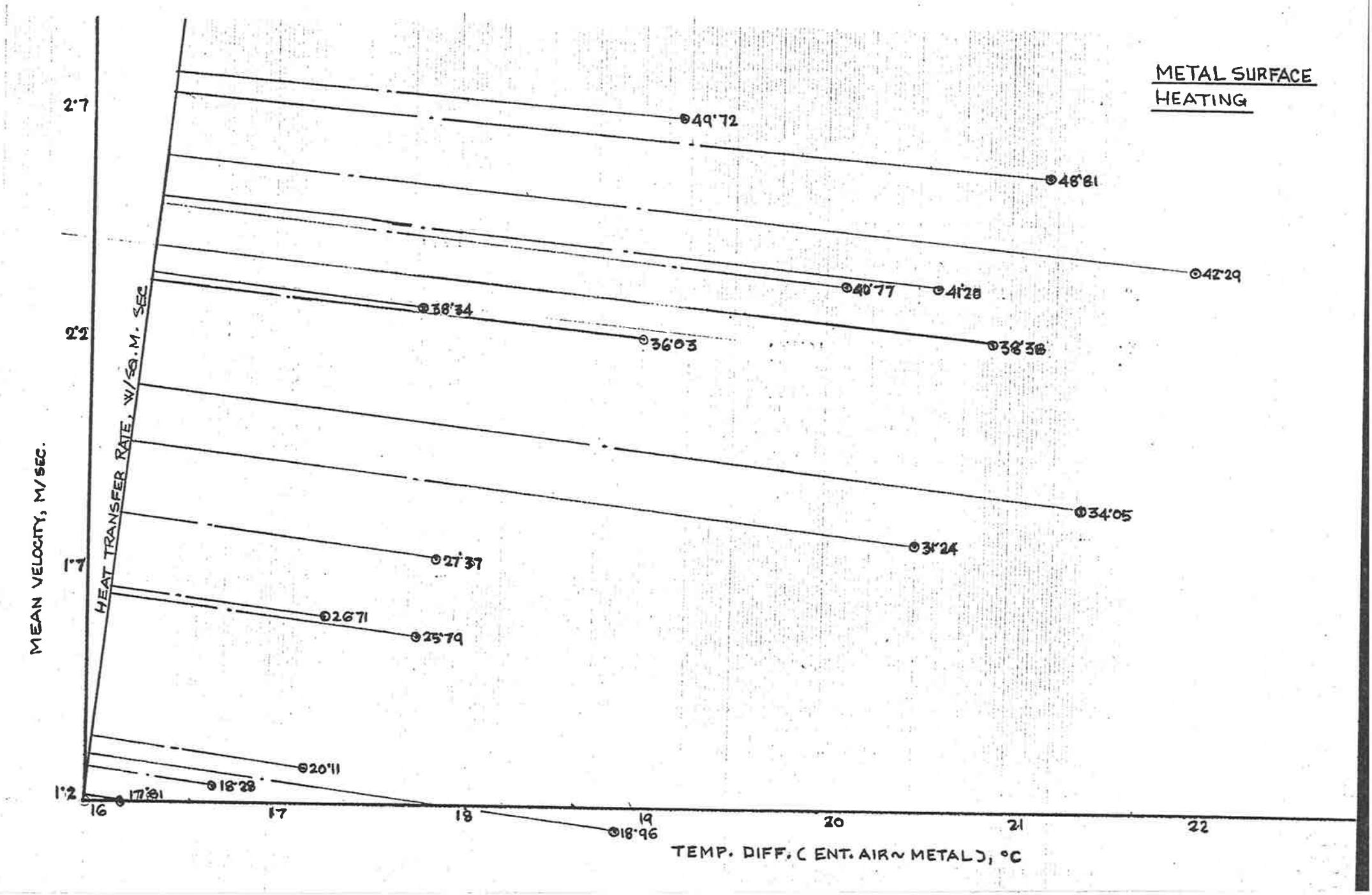
REF	FRESH AIR °CDB GM/KG DA FA	FRESH & RETURN AIR MIXTURE °CDB GM/KG DA FRA	RETURN AIR °CDB GM/KG DA RA	AIR LEAVING COMBINED HORIZONTAL SURFACE °CDB GM/KG DA WA	SUPPLY AIR °CDB GM/KG DA SA	MIXED AIR °CDB GM/KG DA MA	TEMP. UPPER & LOWER LAYERS OF STORAGE °C TSU-TSL	AIR QTY THRU APPARATUS L/S Aqa	TOTAL AIR QTY L/S Aqt	BY-PASS FACTOR, AUTOMATIC BF3	AIRCOND. LOAD WATTS L	THERMAL ENERGY SUPPLY BY THE CONVERTER WATTS QT	LOSS FR APPARA WATTS la
60602	13·5 7·6	21·1 10·8	23·0 11·6	22·0 12·0	39·0 12·5	29·6 11·6	43 39	288	600	0·52	7655	7940	380
60603	13·5 7·6	21·1 10·8	23·0 11·6	22·0 12·0	39·0 12·5	29·6 11·6	43 39	288	600	0·52	7655	7940	380
60604	13·5 7·6	21·1 10·8	23·0 11·6	22·0 12·0	39·0 12·5	29·6 11·6	42·9 38·9	288	600	0·52	7655	7940	380
60605	11·0 7·5	19·0 10·3	21·0 11·0	20·0 11·5	39·0 12·0	28·6 11·0	42·6 38·6	288	600	0·52	8381	7940	414
60606	11·4 7·5	19·0 10·3	20·9 11·0	20·0 11·4	38·6 11·8	29·4 11·0	42·0 38·0	318	600	0·47	8910	7940	462
60607	11·9 7·4	19·0 9·8	20·9 10·4	19·9 10·8	38·0 11·2	29·0 10·5	41·6 37·6	318	600	0·47	8585	7940	402
60608	13·0 7·5	19·0 9·8	20·5 10·4	19·9 10·7	37·6 11·1	28·3 10·5	41·5 37·5	300	600	0·50	7866	7940	401
60609	13·5 7·3	19·5 9·7	21·0 10·3	20·4 10·6	37·0 11·0	29·1 10·4	41·1 37·1	330	600	0·45	8217	7940	396
60610	14·0 7·3	20·4 9·7	22·0 10·3	21·2 10·5	36·7 11·0	27·1 10·2	41·9 37·9	246	600	0·59	5771	7940	295
60611	16·0 6·6	22·0 9·4	23·5 10·1	22·6 10·2	37·8 11·0	28·0 10·0	42·8 38·8	228	600	0·62	5486	7940	205
60612	16·7 6·8	22·5 9·2	24·0 9·8	23·0 10·6	38·6 11·0	28·5 9·9	43·1 39·1	222	600	0·63	5488	6367	202
60613	17·5 7·0	23·5 9·4	25·0 10·0	23·9 10·9	38·8 11·1	28·1 9·9	43·2 39·2	180	600	0·70	4273	4775	173
60614	18·1 8·2	24·1 9·8	25·6 10·2	24·5 11·0	38·7 11·3	28·3 10·2	43·2 39·2	174	600	0·71	3831	3916	146
60615	18·1 8·2	24·1 9·8	25·6 10·2	24·5 11·0	38·7 11·3	28·3 10·2	43·1 39·1	174	600	0·71	3831	3916	146
60616	18·5 9·2	24·5 10·0	26·0 10·2	24·9 11·2	38·7 11·3	28·5 10·4	43·1 39·1	168	600	0·72	3528	3582	140
60617	18·5 9·2	24·5 10·0	26·0 10·2	24·9 11·0	38·7 11·3	28·5 10·4	43·0 39·0	168	600	0·72	3528	3582	140
60618	14·0 7·8	21·6 9·4	23·5 9·8	22·1 10·7	38·7 11·3	26·2 9·8	43·2 39·2	162	600	0·73	4006	4620	195
60619	12·2 7·4	19·8 9·4	21·7 10·0	20·7 10·8	39·0 11·1	27·9 10·1	43·2 39·2	252	600	0·58	7091	7393	302
60620	12·2 7·4	19·8 9·4	21·7 10·0	20·7 10·8	39·0 11·1	27·9 10·1	43·2 39·2	252	600	0·58	7091	7393	302
60621	12·5 7·6	18·9 9·9	20·5 10·4	19·8 11·2	39·0 11·4	27·7 10·6	43·3 39·3	264	600	0·56	7587	7940	316
60622	9·0 6·4	18·2 9·6	20·5 10·4	19·3 10·7	39·2 11·2	29·5 10·5	42·4 38·4	324	600	0·46	9720	7940	359
60623	8·0 5·6	18·0 9·6	20·5 10·6	19·2 10·6	38·4 11·1	30·6 10·5	41·0 37·0	372	600	0·38	10781	7940	535
60624	8·5 6·0	18·5 10·0	21·0 11·0	19·8 10·8	37·0 11·2	30·7 10·8	39·8 35·8	396	600	0·34	10217	7940	570
70601	12·0 7·6	19·2 10·0	21·0 10·6	20·0 10·5	35·6 10·9	28·2 10·5	39·9 35·9	330	600	0·45	7385	7940	396

(C.1.2.4) HEAT AND MASS TRANSFER FOR METAL SURFACE

HEATING & HUMIDIFICATION

METAL SURFACE

AIR QTY L/S	AIR ON °CDB	AIR ON GM/KG D.A.	AIR OFF °CDB	AIR OFF GM/KG OF DA	MEAN METAL TEMP °C	AIR MASS FLOW KG DA/SEC	AIR VELOCITY M/SEC	LOG MEAN TEMP DIFF. °C	SENSIBLE ENERGY TRANSFER WATTS.	LENGTH OF METAL SURFACE M	METAL SURFACE AREA M²	HEAT TRANSFER W/SQM.SEC	TEMP DIFF (ENT. AIR - METAL)	VAP. PRESS. DIFF. KPA	MASS TRANSFER GM/SQM. /SEC
288	22·0	12·0	39·0	12·5	41·0	0·3422	2·22	7·55	5875	16·9	21·6	36·03	19·0	5·901	0·008
288	20·0	11·5	39·0	12·0	40·9	0·3407	2·22	7·92	6566	16·9	21·6	38·38	20·9	5·891	0·008
318	20·0	11·4	38·6	11·8	40·6	0·3762	2·34	7·98	7098	16·9	21·6	41·20	20·6	5·794	0·007
318	19·9	10·8	38·0	11·2	40·0	0·3771	2·34	7·84	6906	16·9	21·6	40·77	20·1	5·750	0·007
300	19·9	10·7	37·6	11·1	39·6	0·3557	2·21	7·71	6336	16·9	21·6	38·04	19·7	5·597	0·007
246	21·2	10·5	36·7	11·0	39·1	0·2902	1·74	7·74	4576	16·9	21·6	27·37	17·9	5·368	0·007
228	22·6	10·2	37·8	11·0	39·9	0·2677	1·61	7·21	4159	16·9	21·6	26·71	17·3	5·664	0·010
222	23·0	10·6	38·6	11·0	40·8	0·2603	1·57	7·46	4156	16·9	21·6	25·79	17·8	6·068	0·005
180	23·9	10·9	38·8	11·1	41·1	0·2104	1·28	7·41	3218	16·9	21·6	20·11	17·2	6·100	0·002
174	24·5	11·0	38·7	11·3	41·2	0·2029	1·24	7·51	2965	16·9	21·6	18·28	16·7	5·956	0·003
168	24·9	11·2	38·7	11·3	41·1	0·1958	1·20	7·23	2782	16·9	21·6	17·81	16·2	6·057	0·001
162	22·1	10·7	38·7	10·8	41·0	0·1917	1·15	7·88	3227	16·9	21·6	18·96	18·9	6·092	0·001
252	20·7	10·8	39·0	11·1	41·2	0·2978	1·78	8·20	5534	16·9	21·6	31·24	20·5	6·129	0·004
264	19·8	11·2	39·0	11·4	41·2	0·3126	1·86	8·31	6114	16·9	21·6	34·05	21·4	6·072	0·004
324	19·3	10·7	39·2	11·2	41·3	0·3846	2·38	8·47	7734	16·9	21·6	42·29	22·0	6·180	0·009
396	19·8	10·8	37·0	11·2	39·0	0·4690	2·70	7·61	8173	16·9	21·6	49·72	19·2	5·217	0·009
372	19·2	10·6	38·4	11·1	40·4	04418	2·58	8·13	8571	16·9	21·6	48·81	21·2	5·935	0·012
330	20·0	10·5	35·6	10·9	37·8	0·3907	2·28	7·46	6178	16·9	21·6	38·34	17·8	4·872	0·007

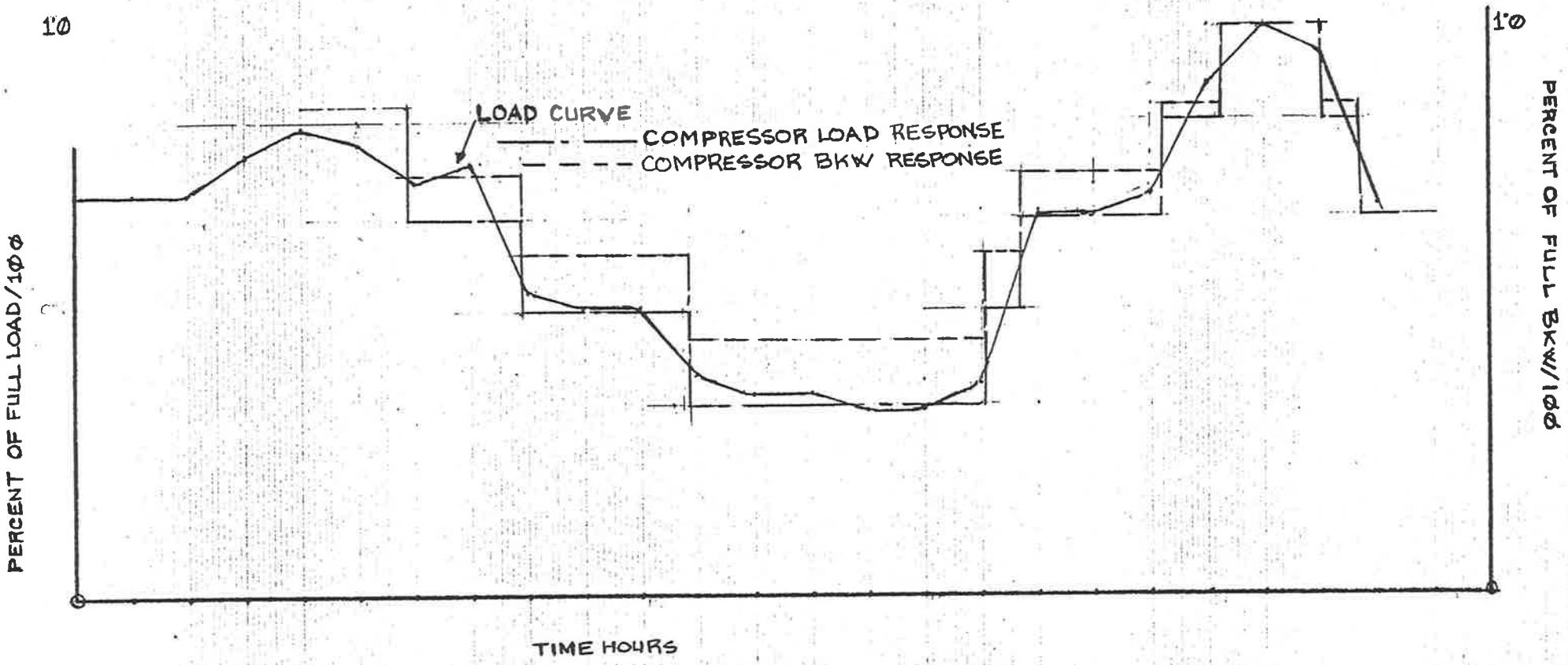

METAL SURFACE HEATING
HEAT TRANSFER RATE, W/SQ.M. SEC
MEAN VELOCITY, M/SEC.
2·7
2·2
1·7
1·2
49·72
46·81
42·29
40·77
41·28
38·34
36·03
38·38
34·05
31·24
27·37
26·71
25·79
20·11
18·28
17·81
18·96
16
17
18
19
20
21
22
TEMP. DIFF. (ENT. AIR ~ METAL), °C

(C.1.2.5) LOAD AGAINST COMPRESSOR RESPONSE

SYSTEM X - CONVENTIONAL SYSTEM
SYSTEM Y - VESSEL/EXCAHNGER SYSTEM

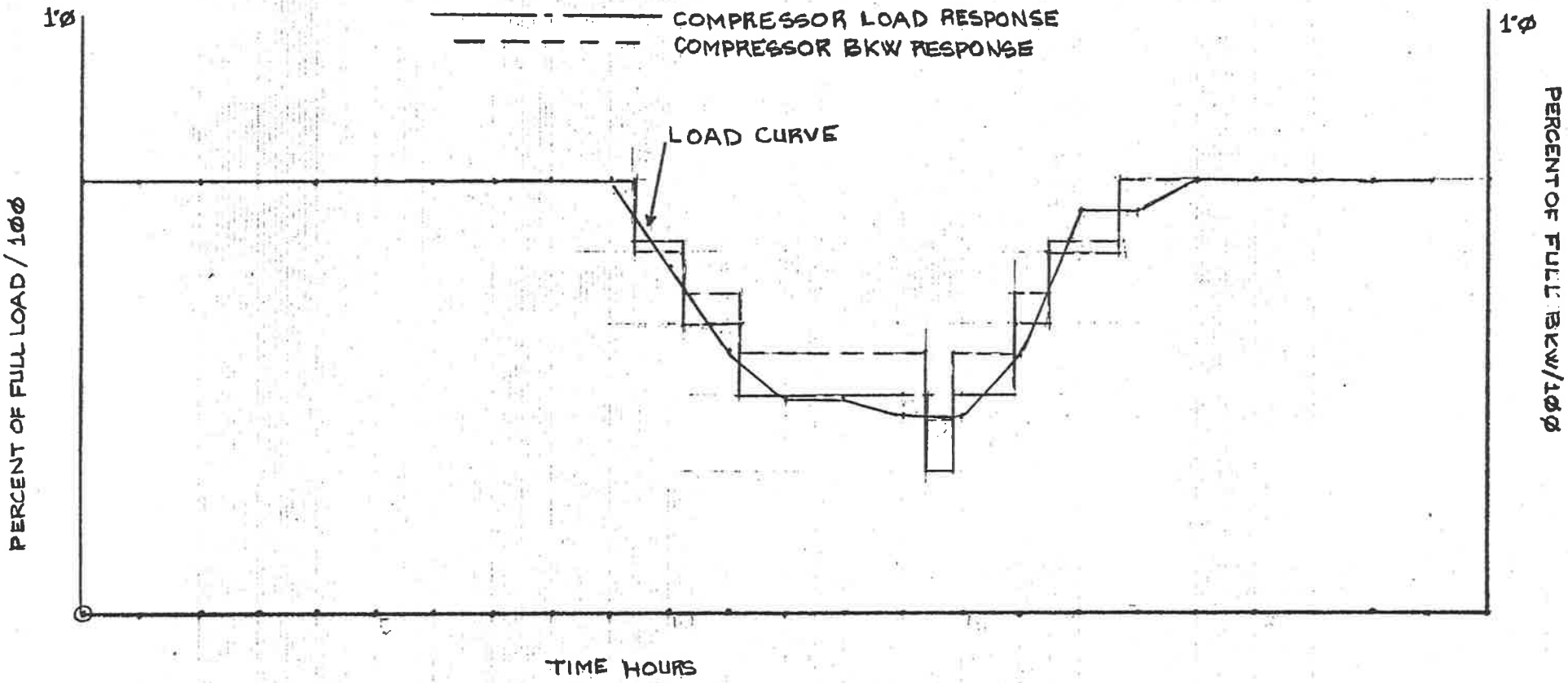
HEATING & HUMIDIFICATION

SYSTEM X



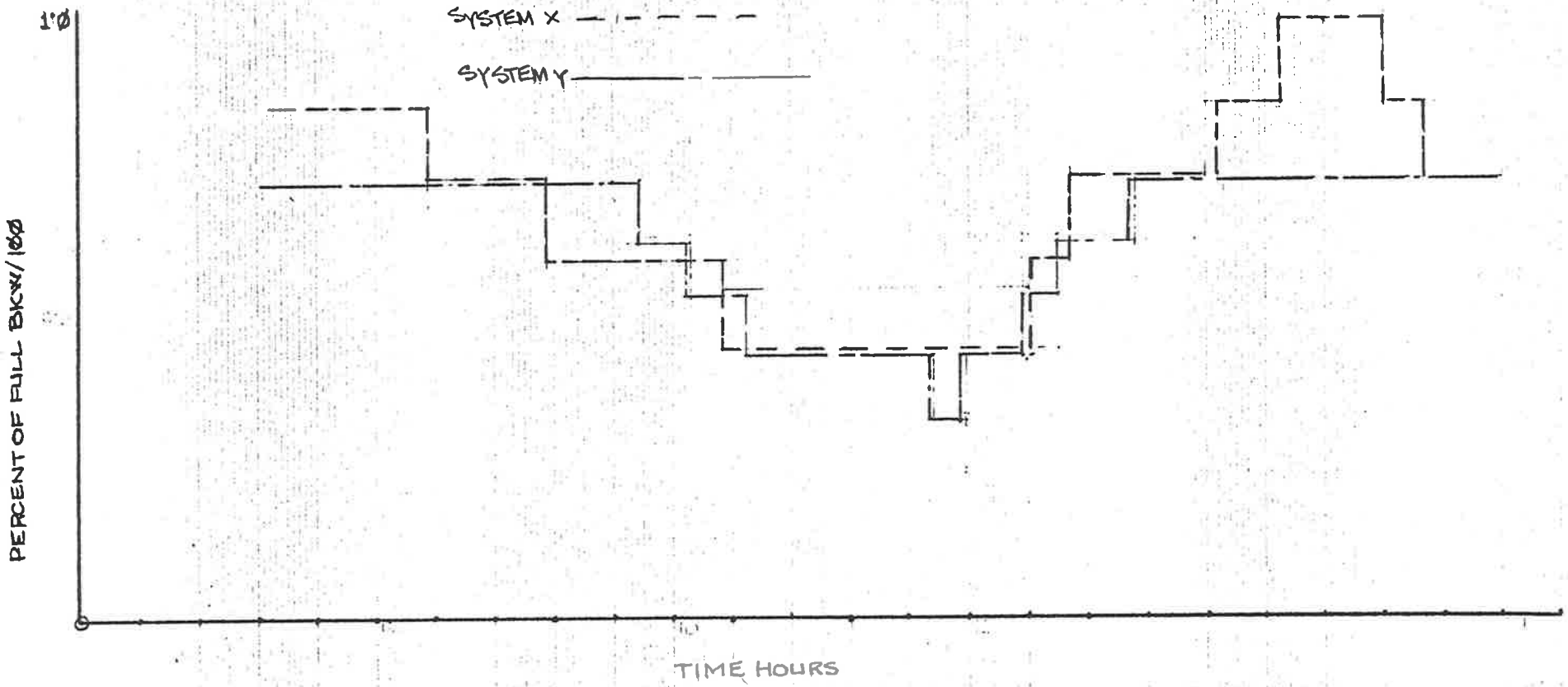
HEATING AND HUMIDIFICATION

SYSTEM Y



(C.1.2.6) BRAKE KILOWATT CONSUMPTION FOR SYSTEMS X AND Y

HEATING & HUMIDIFICATION



(C.1.2.7) RECORDED TEST DATA FOR 47 DAYS

COLUMN 1	YEAR, DATE, HOUR
COLUMN 2 - 9	TEMPERATURES
COLUMNS 10, 11, 12, 13	RELATIVE HUMIDITIES
COLUMN 14	DAMPER POSITION
COLUMNS 15 & 16	COMPRESSOR & PUMP OPERATION INDICATORS

RA - RETURN AIR FROM BUILT ENVIRONMENT

FRA - FRESH & RETURN AIR MIXTURE

WA - AIR LEAVING THE COMBINED SURFACE

SA - AIR LEAVING THE UNIT AFTER THERMAL AIR TREATMENT

21-9-82	RA Rangitata	FRA Ashburton	WA Wiscombe	NWI	WTON	WTON	SA Lower Hutt	NWI	SA Kelvin Park	FRA Ashburton	WA Wiscombe	RA Rangitata	DWTP	CONE	PUMP
0146	19	17	22	34	35	39	36	31	52	78	83	86	64		1
246	"	"	23	39	32	43	"	"	"	77	82	85	"		"
346	"	"	"	"	31	40	"	"	51	75	"	84	"		"
446	18	"	22	"	32	39	"	35	50	70	81	83	"		"
546	"	"	23	34	"	40	"	"	49	73	80	82	"		"
646	"	"	22	35	"	"	"	"	"	72	"	"	"		"
746	20	18	24	39	34	41	"	32	"	"	79	81	"		"
846	22	20	25	36	35	42	37	33	"	71	"	80	63		"
946	27	21	27	37	36	41	38	34	"	69	77	79	"		"
1046	23	"	32	"	31	35	40	32	52	67	80	76	68	0	0
1146	"	22	33	36	"	36	39	35	54	64	76	71	67	"	"
1246	24	"	35	35	"	"	43	"	55	"	77	72	"	"	"
1346	25	23	"	39	30	35	39	31	54	62	76	68	"	"	"
1446	"	"	"	35	"	"	38	30	"	61	"	68	"	"	"
1546	26	"	33	34	29	33	37	"	54	59	75	67	"	"	"
1646	24	22	32	35	28	32	"	29	53	62	76	71	"	"	"
1746	23	21	35	32	27	31	36	28	52	65	77	74	68	"	"
1846	"	"	30	31	25	29	35	"	"	"	"	23	"	"	"
1946	21	20	24	32	29	37	34	29	51	68	76	77	63	1	1
2046	"	"	25	33	30	"	"	"	50	"	77	78	"	"	"
2146	22	21	"	"	"	38	38	30	51	67	"	"	"	"	"
2246	20	23	24	"	31	"	"	"	50	70	78	80	"	"	"
2346	"	18	"	34	"	"	39	"	"	71	79	"	"	"	"
0046 22-9-82	"	19	"	"	32	40	36	31	"	"	"	"	"	"	"
0146	"	18	"	"	"	"	"	"	49	70	78	"	"	"	"
246	"	19	"	"	"	"	"	35	"	68	"	79	"	"	"
346	"	"	"	"	"	"	"	31	48	67	77	78	"	"	"
446	"	18	"	"	33	"	"	"	"	"	"	79	"	"	"
546	"	"	"	"	"	41	"	32	"	"	"	78	"	"	"
646	"	19	25	35	"	42	37	"	"	"	"	"	"	"	"
746	22	20	26	36	34	43	38	33	"	66	76	77	63	1	"
846	24	22	27	"	36	"	"	34	"	"	25	75	"	0	1
946	25	21	35	"	34	34	40	35	55	"	78	73	67	0	0
1046	26	27	34	"	35	36	39	"	"	63	76	70	"	"	"
1146	"	24	"	"	"	"	38	"	"	"	"	69	"	"	"
1246	28	25	30	35	34	35	36	32	48	62	70	70	62	"	1
1346	"	"	29	33	35	29	35	29	50	61	69	68	61	"	"
1446	29	26	"	31	39	26	31	27	57	60	68	66	"	"	"
1546	28	25	28	29	26	24	29	25	52	59	67	65	"		"
1646	31	24	27	27	23	21	26	23	52	58	"	"	"		"
1746	26	27	26	25	21	19	24	21	58	62	70	69	"		"
1846	23	21	24	23	20	"	23	23	64	64	76	71	67	0	0
1946	22	"	"	22	17	20	"	19	"	65	77	73	"	"	"
2046	"	20	23	21	19	19	22	18	66	66	79	75	68	"	"
2146	24	22	24	22	16	18	23	23	"	62	78	71	"	"	"
2246	25	23	"	23	17	23	22	19	64	59	75	68	"	"	"
2346	27	21	"	22	"	"	"	"	62	60	"	"	"	"	"
0046	22	"	27	"	"	"	"	18	"	"	74	"	"	"	"

13-9-82	RA	FRA	WA	HET	WEFF	WTCH	SA	HET	SA	FRA	WA	RA	DRNDK	CONV	RUN
0146	20	19	24	34	32	40	35	31	48	67	76	77	64	1	1
0246	"	18	"	"	33	"	36	"	"	68	77	78	"	"	"
0346	"	"	"	"	"	"	"	35	"	"	"	"	"	"	"
0446	"	19	"	"	"	"	"	31	"	"	"	"	"	"	"
0546	"	"	"	"	"	"	"	"	"	67	"	"	"	"	"
0646	"	"	"	35	34	41	"	32	"	68	"	"	"	"	"
0746	21	20	25	39	"	42	37	"	"	67	"	"	63	"	"
0846	22	21	26	36	35	"	"	33	"	"	76	77	"	0	1
0946	23	"	32	39	32	32	43	31	55	65	74	74	68	0	0
1046	25	22	33	"	35	39	39	"	"	64	77	72	67	"	"
34437 1146	"	21.5 "	"	"	28	36	38	"	"	43 63	76	71	AAB "	195, 135 "	50 "
1246	27	24	35	35	30	39	"	35	56	64	"	72	"	"	"
1346	"	26	30	"	34	31	35	"	49	61	70	70	61	1	1
1446	"	25	28	"	30	28	33	29	50	60	69	68	"	"	"
1546	"	"	"	30	28	25	30	27	53	61	70	70	"	"	"
1646	26	"	30	27	35	23	28	24	56	"	72	71	"	"	"
1746	"	23	26	26	22	20	26	22	61	64	74	73	62	"	"
1846	24	"	25	24	19	23	25	20	66	65	79	75	67	0	0
1946	25	"	"	"	"	18	24	"	64	59	76	70	68	"	"
2046	27	22	24	27	17	23	"	"	63	63	77	72	"	"	"
2146	23	21	"	"	19	19	"	19	"	"	76	71	"	"	"
2246	"	"	"	23	"	"	"	23	62	62	"	"	"	"	"
2346	21	20	23	22	18	"	23	19	"	63	"	"	"	"	"
0046 14-9-82	"	19	22	24	19	26	25	21	58	"	73	73	63	1	1
0146	"	"	"	26	20	28	26	22	53	"	"	22	"	"	"
0246	"	23	"	27	22	30	27	27	52	62	"	"	64	"	"
0346	"	19	27	28	24	31	29	24	60	"	72	"	"	"	"
0446	"	23	"	29	25	32	30	25	"	"	"	"	"	"	"
0546	"	19	23	30	"	"	"	26	49	"	73	73	"	"	"
0646	20	"	22	"	26	33	31	"	"	64	74	75	"	"	"
0746	22	20	24	32	28	39	32	28	50	64	"	74	"	"	"
0846	23	22	26	33	29	37	34	29	51	67	75	75	63	"	"
0946	25	27	30	38	30	30	35	"	55	62	76	69	68	0	0
1046	28	24	29	33	36	29	34	30	48	59	68	67	62	"	1
1146	"	26	"	31	29	26	35	28	50	57	67	66	61		"
1246	29	"	"	29	27	25	29	26	52	"	68	"	"		"
1346	"	"	"	28	25	22	28	24	"	55	64	62	"		"
1446	"	"	"	26	23	20	26	23	50	52	61	59	"		"
1546	28	"	28	25	21	19	24	21	52	"	62	60	"		"
1646	"	25	27	23	19	"	23	19	51	53	60	58	"		"
1746	26	24	25	21	17	"	21	18	59	57	67	65	"		"
1846	24	22	22	20	19	16	20	19	65	59	76	68	67	0	0
1946	26	25	21	"	18	17	"	18	68	"	28	68	"	"	"
2046	"	"	"	"	19	19	21	17	66	56	76	65	68	"	"
2146	"	"	"	"	"	"	"	18	64	55	75	64	"	"	"
2246	"	24	"	"	"	20	"	"	"	"	"	"	"	"	"
2346	23	21	"	23	14	23	20	19	"	59	"	67	"	"	"
0046	"	"	"	19	"	19	19	16	63	58	74	66	"	"	"

28-8-82	RA	FRA	V/A	MET	W COIL OFF	W COIL ON	SA	MET	SA	FRA	V/A	RA	PUMP	CONT	PUMP
1546	27	25	33	39	30	34	37	30	54	58	73	66	67	0	0
1646	"	24	32	35	"	"	36	"	"	59	74	68	"	"	"
1746	25	23	35	34	28	32	36	29	56	64	76	72	"	"	"
1846	23	21	26	33	29	38	34	"	52	70	"	78	62	1	1
1946	24	23	27	34	30	"	39	30	"	65	"	77	63	"	"
2046	23	22	26	"	"	"	35	"	"	66	78	79	64	"	"
2146	22	21	25	35	31	39	36	31	54 67	69	81	82	"	"	"
2246	"	"	26	39	32	40	"	"	52	68	80	81	"	"	"
2346	21	20	25	35	"	"	"	32	51	"	79	80	"	"	"
29-8-82 0046	"	"	"	36	"	"	37	31	50	"	78	"	"	"	"
0146	"	"	"	35	33	41	"	32	"	67	"	"	"	"	"
246	"	"	"	36	34	"	"	"	49	68	77	79	"	"	"
346	22	"	"	"	"	42	"	33	48	66	"	78	63	"	"
446	"	"	"	37	"	"	"	"	"	"	"	"	"	"	"
546	"	"	26	"	35	43	38	"	"	"	76	78	"	"	"
646	"	"	"	36	"	42	"	"	"	65	"	77	"	0	"
746	23	21	27	"	39	43	37	"	"	"	75	76	"	"	"
846	25	23	28	37	36	"	38	34	"	63	74	74	62	"	"
946	26	24	34	36	33	34	39	32	55	"	77	70	67	0	0
			RECORDER OFF												
METER 331/200	26.5	25			30	30.5	33		28	27		27	AHB 25.5, By Pass	14.5 - 29 0	0
1-9-82 1130	25	24			33.5	30	31.5		34	38		34	AHB 25, Cooling	13 - 54 1	1
3-9-82 1115	18	19			35	40	34		31	66		64	AHB 13, Heating	9.5 - 64 1	1
METER 335.33.															

22-8-92	RA	FRA	WIA	MET	W.T.OFF	W.T.ON	SA	MET	SA	FRA	WIA	RA	DRIVE	CON2	AMP
0145	21	19	25	36	32	40	36	32	57	69	80	92	64	1	1
245	20	"	"	"	"	"	"	"	52	70	81	"	"	"	"
345	"	18	24	35	33	41	37	"	51	71	"	84	"	"	"
445	"	"	"	"	"	"	"	"	"	"	82	"	"	"	"
545	19	17	"	39	32	40	"	"	52	72	"	85	"	"	"
645	18	"	23	35	33	"	36	31	51	73	"	"	"	"	"
745	19	18	24	39	"	41	37	"	"	"	"	84	"	"	"
845	21	20	25	36	34	"	"	33	52	72	"	83	"	"	"
945	27	21	27	"	35	"	38	"	53	70	81	"	63	0	1
1045	"	25	33	"	32	32	40	32	59	66	82	77	68	0	0
1145	28	27	34	37	28	35	39	"	"	64	80	76	67	"	"
1245	27	24	"	36	37	36	"	"	"	66	"	"	"	"	"
1345	"	25	"	"	30	"	38	35	55	"	78	75	"	"	"
1445	"	24	"	"	"	39	"	37	56	63	76	70	"	"	"
1545	"	25	35	35	"	34	"	31	"	67	"	"	"	"	"
1645	"	"	33	"	29	35	37	30	58	64	78	75	"	"	"
1745	25	23	35	34	27	"	36	29	"	69	79	77	"	"	"
1845	"	24	"	33	26	30	"	"	61	"	81	80	68	"	"
1945	26	25	34	"	24	29	35	"	"	66	80	77	"	"	"
2045	25	24	31	"	23	"	"	28	63	68	82	80	"	"	"
2145	"	23	30	35	"	28	34	"	62	69	82	"	"	"	"
2245	23	21	26	32	28	37	33	29	56	71	80	81	63	1	1
2345	"	"	"	33	29	"	34	30	"	"	81	82	64	"	"
23-8-92 0045	22	20	25	34	30	"	35	"	54	"	"	"	"	"	"
0145	"	"	"	"	31	29	"	31	"	"	"	"	"	"	"
245	"	"	24	39	35	"	"	35	53	72	"	85	"	"	"
345	21	"	25	36	32	40	36	31	"	"	"	"	"	"	"
445	"	19	"	"	"	"	37	32	52	"	"	"	"	"	"
545	"	"	"	"	"	41	"	"	"	"	"	"	"	"	"
645	"	23	"	"	33	"	"	"	"	"	"	"	"	"	"
745	22	20	26	37	34	"	"	33	"	"	"	"	"	"	"
845	24	22	27	"	36	"	38	34	"	71	80	81	63	0	1
945	27	24	33	"	31	33	40	32	58	65	81	76	68	0	0
1045	30	27	32	"	37	34	38	34	51	63	73	73	62	"	1
1145	29	26	31	34	34	31	39	35	52	"	72	72	61	"	"
1245	28	"	30	31	31	28	33	29	54	60	"	"	"	"	"
1345	"	25	29	30	28	25	30	27	56	59	"	71	"	"	"
1445	"	"	"	28	25	23	28	25	57	"	71	70	"	"	"
1545	31	"	27	26	23	21	26	23	59	"	"	"	"	"	"
1645	27	24	"	24	21	18	24	21	60	"	"	69	"	"	"
1745	"	26	"	27	19	17	27	20	64	60	73	70	"	"	"
1845	27	25	26	22	16	15	21	18	68	62	74	72	62	"	"
1945	"	"	"	20	15	13	20	17	73	"	76	74	64	0	0
2045	24	22	21	"	17	16	"	"	72	64	81	"	68	"	"
2145	27	21	"	23	18	19	"	16	70	62	79	72	"	"	"
2245	23	"	"	"	15	18	"	19	69	61	"	71	"	"	"
2345	"	"	"	"	19	19	"	"	68	62	78	"	"	"	"
0045	22	20	22	19	12	20	4	16	63	"	74	72	63	0	1

20-8-82	RA	FRA	WESCOM	MIST	WESTCLIFF	WTON	SA	MIST	SA	FRA	W/A	RA	DRIP	COMM	PUNT
0145	23	21	26	34	34	39	36	31	57	62	75	76	64	1	1
245	27	"	"	35	32	"	"	32	50	67	76	77	63	"	"
345	"	"	"	"	33	41	"	"	"	64	77	"	"	"	"
445	"	"	"	36	"	"	37	33	"	"	"	78	"	"	"
545	23	"	"	"	34	"	38	"	"	65	78	79	"	"	"
645	27	"	27	37	"	42	"	"	"	"	"	"	"	"	"
745	24	22	"	"	35	43	"	34	"	"	77	"	64	"	"
845	25	"	28	"	36	42	"	"	"	66	"	75	63	"	"
945	"	27	"	"	"	41	"	"	57	"	"	"	"	"	"
32591 1045	28	25	34	"	34	35	39	35	57	62	79	72	AMB 67	20, 136 = 48 "	0
1145	"	26	"	"	30	37	43	"	"	61	77	71	"	"	"
1245	27	25	"	36	31	36	39	"	"	"	"	"	"	"	"
1345	28	26	"	35	"	35	38	"	56	60	76	69	"	"	"
1445	27	25	"	36	30	34	"	31	"	"	"	70	"	"	"
1545	"	24	"	39	"	33	37	30	"	61	"	"	"	"	"
1645	31	26	35	34	29	"	"	"	57	"	"	"	"	"	"
1745	25	24	32	"	28	35	36	29	58	66	78	74	"	"	"
1845	27	25	35	"	26	31	"	"	59	63	"	73	"	"	"
1945	"	26	"	33	"	30	"	"	"	62	"	72	68	"	"
2045	24	22	31	"	25	"	36	37	58	66	"	75	"	"	"
2145	"	"	"	32	"	29	34	"	59	67	79	76	"	"	"
2245	"	"	30	"	"	"	"	"	61	68	81	79	"	"	"
2348	"	"	"	34	24	"	"	26	"	67	80	78	"	"	"
0045 21-8-82	"	"	"	35	"	"	33	27	60	66	79	77	"	"	"
0145	"	"	29	"	"	28	"	"	"	64	"	75	"	"	"
245	23	21	"	31	"	"	"	26	58	63	77	73	"	"	"
345	"	"	"	30	"	"	35	"	"	"	"	"	"	"	"
445	"	"	26	"	27	34	34	27	52	"	24	74	65	"	1
545	"	"	24	32	"	"	33	28	"	"	76	76	"	"	"
645	22	"	"	"	29	36	"	"	"	65	77	75	64	1	"
745	23	20	26	33	30	37	34	30	"	69	"	"	"	"	"
845	24	22	"	34	"	"	39	"	53	67	78	79	63	"	"
945	25	27	28	36	32	40	37	35	52	68	77	77	"	"	"
1045	26	23	32	"	"	33	38	31	58	"	79	75	68	0	0
1145	"	24	"	39	31	34	37	30	57	"	77	76	67	"	"
1245	"	"	33	34	29	"	"	"	58	"	"	74	"	"	"
1345	"	"	32	"	28	"	36	"	"	68	28	75	"	"	"
1445	27	25	"	"	29	35	"	"	59	67	79	"	"	"	"
1545	26	24	36	33	28	"	"	29	60	69	"	76	"	"	"
1645	25	23	"	35	31	30	39	"	61	72	80	78	"	"	"
1745	24	22	31	32	26	"	35	28	62	76	81	81	"	"	"
1845	23	21	26	"	28	36	34	29	57	"	"	83	63	1	1
1945	"	"	25	33	"	37	"	"	56	74	82	84	"	"	"
2045	24	27	27	34	30	38	35	31	54	65	78	79	64	"	"
2145	25	23	"	35	31	39	36	"	53	66	77	78	"	"	"
2245	23	21	26	"	"	"	"	32	52	76	79	80	"	"	"
2345	22	20	25	39	32	40	"	"	"	68	"	81	"	"	"
0045	"	"	"	35	"	"	37	"	51	69	82	"	"	"	"

18-8-82	RA	FRA	WIA	HEF	WTOFF	WTON	SA	HEF	SA	FRA	WIA	RA	PPHT	ECHT	ROAD
0145	20	18	24	35	33	42	37	32	53	75	85	88	64	0	1
245	19	17	23	39	"	41	"	"	"	"	"	"	—		"
345	23	"	"	"	"	"	"	"	"	76	"	"	"		"
445	20	18	24	"	34	42	"	"	"	75	"	87	"		"
545	"	"	"	"	"	41	"	"	52	74	84	"	"		"
645	19	"	"	"	"	42	"	"	"	"	"	—	"		"
745	23	"	"	34	33	"	"	"	"	75	"	"	"		"
845	22	19	25	36	35	"	38	"	"	71	83	85	"		"
945	25	23	28	"	36	41	"	34	"	67	78	80	63		"
1045	24	21	33	35	34	~~43~~ 34	~~35~~ 43	35	57	64	80	77	68	0	0
1145	"	22	32	34	31	39	38	30	"	65	"	76	67	"	"
1245	"	-	33	35	14	19	37	35	25	64	81	75	—	"	"
1345	"	21	30	34	15	18	37	"	71	63	82	74	"	"	"
1445	25	22	29	"	17	20	36	29	63	61	"	71	"	"	"
1545	"	"	28	33	18	22	37	"	62	60	81	"	"	"	"
1645	24	"	"	"	"	24	35	28	63	62	82	73	"	"	"
1745	"	23	"	32	"	31	34	"	65	66	84	77	68	"	"
1845	"	22	27	"	21	28	"	26	"	67	"	"	"	"	"
1945	27	"	"	31	"	27	32	"	"	66	83	—	"	"	"
2045	23	"	25	30	20	"	31	"	56	"	79	78	64	1	1
2145	21	19	23	"	26	33	"	"	57	68	80	81	"	"	"
2245	"	"	27	"	"	34	35	"	"	69	81	82	—	"	"
2345	"	"	23	31	28	35	32	27	52	"	"	"	"	"	"
0045	"	"	"	32	"	36	33	28	"	"	"	"	"	"	"
19-8-82															
0145	"	23	24	33	29	37	"	29	55	"	"	"	"	"	"
245	"	19	"	"	"	-	34	"	54	"	"	"	"	"	"
345	"	23	"	34	31	39	35	30	53	67	80	81	"	"	"
445	"	"	"	"	"	43	"	"	52	"	79	"	"	"	"
545	"	19	25	35	32	39	36	"	57	"	"	"	"	"	"
645	20	"	24	39	"	"	"	35	"	68	80	82	"	"	"
745	21	"	25	36	33	41	37	32	50	67	79	80	"	"	"
845	23	20	26	37	34	42	38	33	"	"	78	79	63	"	"
945	26	23	32	36	35	34	39	55	59	64	81	77	68	0	0
1045	"	24	33	"	"	36	38	"	57	"	78	74	67	"	"
1145	25	23	35	35	30	"	"	31	55	61	76	68	"	"	"
1245	28	26	34	36	"	35	"	35	57	60	77	72	"	"	"
1345	31	25	35	"	"	"	37	"	58	"	78	74	"	"	"
1445	26	"	33	35	"	"	"	31	57	59	76	70	"	"	"
1545	"	24	"	"	~~30~~	"	"	30	52	"	"	69	"	"	"
1645	"	23	32	34	28	"	36	29	58	60	78	74	"	"	"
1745	23	22	35	33	27	31	39	28	60	65	80	79	"	"	"
1845	"	21	26	"	30	37	34	29	54	68	77	80	63	1	1
1945	24	23	27	34	"	38	39	30	53	64	"	78	"	"	"
2045	25	24	28	35	35	43	36	31	52	62	76	76	"	"	"
2145	26	"	29	36	32	40	37	32	51	61	80	"	68	0	0
2245	"	"	32	35	30	32	"	30	57	"	78	73	"	"	"
2345	24	23	35	34	28	33	36	29	56	62	"	"	"	"	"
0045	22	21	30	33	"	34	"	"	54	"	74	"	63	1	1

14-8-92	RA	FRA	WS	MAT	WTOP	2TON	SA	MBC	SA	RA	WS	FRA	DRHT	COMP	RDP
0140	20	19	25	36	37	42	38	33	53	76	88	88	64		1
240	"	18	"	"	38	41	"	"	"	77	"	89	"		"
340	20	"	24	35	37	"	"	"	"	76	"	"	"		"
440	20	"	"	36	"	"	"	"	"	78	86	"	"		"
540	23	"	"	35	"	"	"	"	"	"	"	"	"		"
640	20	17	"	"	"	42	"	"	"	77	"	"	"		"
740	20	"	23	37	"	"	37	32	"	"	"	"	"		"
840	20	18	25	35	"	"	38	"	54	"	85	88	"		"
940	24	22	28	36	38	41	"	34	55	73	83	85	63		"
1040	23	21	27	"	37	"	"	33	"	"	"	"	"		"
1140	24	22	"	"	36	42	"	"	54	72	82	84	"		"
1207	21	21			37.5	41	33		41	60		60	AMB 15, 11		61
1240	23	22	27	36	36	42	38	33	55	73	83	85	63		1
1340	"	"	"	37	35	41	"	"	54	72	81	84	"		"
1440	24	"	28	38	36	"	"	"	52	69	79	82	"		"
1540	23	21	27	37	39	40	"	"	51	70	"	81	"		"
1640	27	"	"	"	35	"	"	"	"	71	80	82	"		"
1740	24	22	"	"	34	42	39	"	52	"	"	"	"		"
1840	23	"	"	38	"	"	"	34	"	"	81	83	64		"
1940	22	20	26	"	39	"	"	33	53	74	83	86	"		"
2040	21	19	25	"	"	"	38	34	55	76	86	89	"		"
2140	27	22	27	"	35	"	39	"	54	72	83	86	"		"
2240	23	"	"	"	"	"	"	"	53	"	"	85	"		"
2340	"	"	"	37	"	"	"	"	54	73	82	"	"		"
0040	24	"	"	"	36	40	"	33	"	75	83	"	"		"
15-8-92															
0140	21	20	26	"	39	41	38	"	55	79	86	89	"		"
240	"	19	25	"	"	"	37	32	"	80	"	90	"		"
340	20	"	"	"	33	"	38	"	"	79	"	"	"		"
440	"	"	24	"	34	42	"	33	54	77	"	89	"		"
540	"	18	25	"	"	"	"	"	"	78	"	"	"		"
640	"	"	24	"	35	"	"	"	53	"	"	"	"		"
740	"	"	25	"	36	41	"	"	"	76	88	"	"		"
840	"	"	"	"	"	40	"	"	"	74	84	88	"		"
940	23	22	27	"	"	42	"	"	"	69	82	84	"		"
1040	24	"	"	"	35	"	"	34	"	67	81	82	63		"
1140	22	20	26	36	"	41	"	33	52	72	"	84	"		"
1240	23	21	27	"	39	42	"	"	53	69	"	83	"		"
1340	22	"	26	"	35	"	37	"	56	76	86	88	68		"
1440	"	20	"	"	"	40	36	"	55	77	85	"	"		"
1540	21	"	"	35	"	41	37	"	"	76	"	87	"		"
1640	22	"	25	36	34	"	"	"	54	75	"	"	64		"
1740	21	19	"	"	"	"	38	"	"	"	"	"	"		"
1840	20	18	"	35	"	"	37	"	53	76	"	88	"		"
1940	22	20	26	36	"	42	38	"	54	73	84	87	"		"
2040	"	22	27	37	35	41	"	34	"	72	"	85	"		"
2140	"	20	26	"	"	"	"	33	55	"	83	"	"		"
2240	21	"	"	36	34	42	"	"	"	"	"	"	"		"
2340	20	18	25	"	35	41	"	"	52	73	"	"	"		"
0040	20	17	24	35	"	42	"	"	"	75	85	88	"		"

11-8-87	RA	FSA	WA	HAT	WROFF	WRON	SA	NIGT	SA	FRA	WA	RA	BAMP	ECHP	Diar
0140	21	19	26	36	37	44	38	33	55	79	86	89	64		1
240	"	23	25	"	38	43	"	"	"	"	"	80	"		"
340	20	19	24	"	37	44	"	"	54	78	"	89	"		"
440	"	"	25	"	"	"	"	"	55	79	"	90	"		"
540	"	18	"	"	38	"	"	"	"	"	87	"	—		"
640	"	19	"	"	"	"	"	"	"	80	"	"	"		"
740	"	"	"	35	"	"	—	32	"	"	"	"	"		"
840	"	18	"	36	37	"	"	35	"	"	"	"	"		"
940	"	19	"	"	38	42	"	"	56	81	87	"	"		"
1040	27	22	27	"	"	"	"	"	"	78	86	88	63		"
1140	24	"	"	"	37	41	"	"	"	76	85	87	"		"
1240	"	"	28	"	"	44	"	"	57	"	"	"	"		"
1340	25	23	"	"	"	43	"	34	56	74	84	86	"		"
1440	24	"	"	—	"	44	"	"	55	73	83	55	"		"
HAT/1540	22	20	26	35	"	43	37	33	52	"	82	84	63		"
3/8/87 1540	19.5	19.0			38	41	34		36	61		61	AMB	13.1	15.84
1640	22	20	26	37	36	42	38	"	53	73	82	85	64		1
1740	21	"	"	"	"	43	"	32	54	74	84	87	"		"
1840	"	19	25	38	37	"	"	33	55	76	86	89	"		"
1940	23	21	26	"	"	"	39	34	52	72	83	86	"		"
2040	"	"	27	"	"	"	43	"	53	"	"	85	"		"
2140	"	22	"	"	38	"	39	35	"	71	"	"	"		"
2240	27	"	"	"	"	"	43	34	"	"	82	"	"		"
2340	21	20	26	"	37	44	39	"	"	73	83	86	"		"
0040	20	18	24	37	"	43	38	33	52	75	84	88	"		"
13-8-87 0140	19	"	"	36	"	"	"	"	"	"	"	"	"		"
240	"	"	"	37	38	42	"	"	"	76	85	"	"		"
340	20	"	"	"	"	"	39	34	"	75	84	87	"		"
440	"	"	"	"	"	"	38	33	"	"	"	88	"		"
540	19	"	"	"	37	"	"	"	"	"	"	87	"		"
640	20	17	25	"	"	"	"	"	"	"	"	"	"		"
740	"	18	"	"	38	41	"	"	"	"	"	"	"		"
840	"	"	"	36	"	"	"	"	"	"	"	"	"		"
940	21	23	"	37	37	"	"	35	53	"	"	"	"		"
1040	23	21	26	"	"	42	"	33	54	73	83	86	63		"
1140	"	22	28	"	"	"	"	34	55	72	"	85	"		"
1240	"	21	27	"	"	"	"	33	56	"	85	87	"		"
1340	24	22	"	36	36	"	"	"	55	"	83	85	"		"
1440	"	"	28	"	37	40	"	"	54	71	82	84	"		"
1540	25	23	31	37	34	39	40	32	61	68	87	82	68	C	C
1640	24	22	33	36	35	36	43	31	60	70	85	83	"	"	"
1740	25	23	28	"	"	41	37	33	57	72	84	86	63	1	1
1840	"	27	"	37	36	42	39	34	55	71	82	84	"	"	"
1940	24	23	"	"	37	"	"	"	56	73	84	86	64	"	"
2040	"	"	"	"	"	"	"	33	55	74	83	85	"	FAULT	"
2140	"	"	27	"	"	"	"	"	56	72	"	"	"		"
2240	27	22	"	"	"	41	38	"	54	"	"	"	"		"
2340	21	20	26	36	"	42	"	34	"	75	84	87	"		"
0040	20	23	25	37	"		"	33	"	76	85	88	"		"

10-8-82	RA	FRA	WA	MAT	WCOFF	WTON	SA	MIST	AA	FRA	WA	RA	DAN?	CON?	PAN?
0140	22	20	25	34	33	40	39	31	56	78	83	85	64	1	1
0240	21	"	"	"	34	41	36	"	"	79	84	87	"	"	"
0340	"	"	"	35	"	"	"	35	"	80	86	88	"	"	"
0440	"	23	"	"	35	"	37	32	"	"	"	"	"	"	"
0540	"	19	"	"	"	42	"	"	55	79	"	"	"	"	"
0640	"	"	"	36	36	43	"	33	"	"	85	89	"	"	"
0740	"	"	"	"	"	"	38	"	54	78	"	88	"	"	"
0840	"	"	"	37	37	44	"	"	53	77	84	87	"	"	"
0940	22	20	26	"	38	"	"	34	54	76	"	"	"	0	"
1040	24	22	28	"	"	45	39	"	"	74	82	94	63	"	"
1140	"	"	"	38	37	44	39	"	"	72	81	87	"	"	"
3/6/84 1240	21	21			38.5	43.5	33		41	54		88	AMB	16, 12.5 =	67
1240	25	23	28	38	37	43	39	34	53	76	80	82	63	0	1
1340	"	24	32	37	35	38	41	35	69	69	87	"	68	0	0
1440	26	"	34	36	"	35	40	35	"	67	80	79	"	"	"
1540	"	"	"	"	30	"	43	"	60	69	82	81	"	"	"
1640	24	22	33	35	28	34	38	30	"	74	"	83	"	"	"
1740	25	24	32	39	"	33	"	"	61	73	"	"	"	"	"
1840	24	27	"	35	27	35	37	"	"	"	"	82	"	"	"
1940	22	21	26	"	33	41	36	31	56	76	"	85	63	1	1
2040	21	20	25	"	34	"	"	"	"	78	84	87	64	"	"
2140	25	22	26	36	35	"	37	32	"	76	83	86	"	"	"
2240	"	"	27	37	"	42	"	33	55	74	"	85	"	"	"
2340	21	20	26	"	36	43	"	32	"	78	85	88	"	"	"
0040	"	19	25	"	"	"	38	33	54	79	85	"	"	"	"
11-8-82 0140	"	23	"	"	37	44	"	"	"	"	"	89	"	"	"
0240	20	19	"	"	"	"	"	"	"	"	86	"	"	"	"
0340	"	"	"	38	"	"	"	"	"	80	"	"	"	"	"
0440	"	"	"	37	38	"	"	"	"	81	"	90	"	"	"
0540	"	"	"	36	"	"	"	"	58	"	"	"	"	0	"
0640	"	18	"	37	37	"	"	"	"	"	87	91	"	"	"
0740	"	"	24	"	"	"	"	"	"	82	"	"	"	FULL	"
0840	"	"	25	"	38	45	38	"	"	"	88	"	"		"
0940	"	"	"	36	"	41	"	"	56	"	87	92	"		"
1040	"	19	"	"	37	44	"	"	"	"	89	91	"		"
1140	24	22	27	37	38	43	39	"	"	74	84	87	63		"
1240	25	27	28	"	37	44	"	34	56	73	85	85	"		"
1340	"	23	"	"	"	"	"	"	56	75	84	86	"		"
1440	"	24	"	"	38	41	"	"	58	"	86	89	"		"
1540	24	27	"	"	37	43	"	"	"	"	"	"	"		"
1640	25	23	"	"	"	44	"	"	56	73	84	87	"		"
1740	23	21	27	"	"	"	43	"	"	76	86	89	64		"
1840	24	23	28	"	38	43	39	"	"	75	85	87	"		"
1940	"	"	"	"	37	44	"	"	"	"	84	"	"		"
2040	"	"	"	"	"	"	43	"	"	74	"	86	"		"
2140	"	27	"	"	"	"	40	"	55	"	"	"	"		"
2240	23	21	27	"	38	42	38	"	"	76	85	88	"		"
2340	22	20	26	36	37	44	"	33	56	78	86	89	"		"
0040	21	"	25	"	"	"	"	"	55	79	"	"	"		"

	RA	FRA	WA	HRT	WTOFF	WTON	SA	HRT	SA	FRA	WA	RA	DISMP	ECHT	PUMP
0140	21	19	25	37	37	43	38	32	49	63	78	80	64	1	1
240	"	"	"	"	"	"	"	33	52	"	"	79	"	"	"
340	20	"	"	"	"	"	"	"	49	64	"	80	"	"	"
440	"	"	24	36	"	"	"	"	"	65	79	81	"	"	"
540	"	18	"	"	"	"	"	"	"	66	"	82	"	"	"
640	33	"	"	"	"	"	37	32	"	67	80	"	"	"	"
740	20	23	"	"	36	"	"	"	50	"	81	83	"	"	"
840	24	"	27	37	38	44	39	34	"	64	28	79	"	"	"
940	"	22	28	38	"	45	43	"	47	60	74	75	63	0	1
1040	"	"	"	37	39	"	39	"	45	"	72	72	"	"	"
1140	25	27	33	36	36	38	41	32	56	59	79	"	68	0	0
1240	26	23	34	35	34	37	40	35	55	"	76	70	67	"	"
1340	25	24	"	39	32	"	43	"	54	54	75	67	"	"	"
1440	26	"	"	35	"	36	39	"	"	"	"	66	"	"	"
1540	25	"	"	"	31	35	38	30	"	"	"	67	"	"	"
1640	"	23	33	34	30	34	"	"	55	56	"	68	"	"	"
1740	23	21	27	34	34	41	36	35	47	62	71	72	62	1	1
1840	22	20	26	"	"	"	"	"	49	63	76	77	63	"	"
1940	"	"	25	"	"	"	"	31	52	64	79	81	64	"	"
2040	"	"	26	35	39	42	37	32	57	62	"	"	"	"	"
2140	24	23	27	"	36	43	"	"	49	53	75	76	"	"	"
2240	25	"	28	36	"	"	38	34	48	53	75	74	"	"	"
2340	24	22	"	37	37	44	39	"	47	"	"	"	63	"	"
0040	23	20	27	36	38	"	38	34	"	55	74	75	64	"	"
9-8-82															
0140	22	"	26	37	"	"	39	"	46	"	75	"	"	"	"
140	"	"	"	36	"	"	38	"	"	"	"	76	"	"	"
340	"	"	"	"	"	"	"	33	"	"	"	"	"	"	"
440	"	"	"	37	"	45	"	34	"	52	"	"	"	"	"
540	"	19	"	"	"	44	"	"	47	57	76	77	"	"	"
640	21	"	"	"	39	43	39	35	46	56	"	"	"	0	1
740	22	20	"	36	38	44	38	34	"	"	"	"	"	"	"
840	23	21	27	"	39	45	"	33	47	57	75	76	63	"	"
940	24	24	34	"	36	35	40	35	55	54	78	69	68	0	0
1040	28	25	"	"	34	37	"	"	"	"	76	66	67	"	"
3161 8KWH	[redacted]	[redacted]			[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			"	[redacted]	[redacted]
1140	27	24	"	37	39	37	40	32	53	52	74	64	67	0	0
1240	"	"	"	36	35	36	43	35	55	55	78	70	"	"	"
1340	"	25	"	"	31	39	39	"	54	54	73	63	"	"	"
1440	28	"	"	"	30	34	38	"	"	53	74	64	"	"	"
1540	26	23	33	39	"	"	37	30	"	55	"	66	"	"	"
1640	25	"	32	34	29	33	"	"	"	"	"	"	"	"	"
1740	23	22	"	35	28	32	35	29	56	64	76	72	"	"	"
1840	24	"	35	32	27	35	39	28	"	62	27	73	68	"	"
1940	"	"	31	"	26	30	34	"	57	63	"	"	"	"	"
2040	"	23	30	"	25	"	"	"	58	65	78	74	"	"	"
2140	"	22	"	35	"	29	"	27	59	68	79	75	"	"	"
2240	23	21	26	32	30	37	33	29	64	72	78	80	63	1	1
2340	"	"	25	33	35	38	34	"	"	71	80	81	4	"	"
0040	22	20	26	"	31	"	35	30	55	74	81	82	"	"	"

4-8-82	SHEED RA	RWY REF FRA	WTSURF WS	MAT	WTOFF	WTCH	WTSURF SA	MAT	LEV AIR SA	RWY REF RA	WTSURF WS	WTSURF FRA	DAMP	CONT	PUMP
1440	23	22	25	39	31	36	39	30	56	63	77	74	67	0	0
1540	"	21	33	35	30	34	38	"	"	65	"	"	"	"	"
1640	"	"	27	36	35	41	37	35	52	"	75	76	63	1	1
1740	24	23	"	"	34	"	"	32	51	64	76	78	"	"	"
1840	27	22	"	37	36	42	"	33	52	65	79	80	64	"	"
1940	20	23	25	36	"	"	"	32	51	69	81	83	"	"	"
2040	"	18	24	"	"	41	"	"	50	70	"	84	"	"	"
2140	20	"	"	"	"	"	"	"	"	69	"	83	"	"	"
2240	21	21	25	"	"	42	"	"	"	66	80	82	"	"	"
2340	20	18	23	"	"	"	"	"	"	69	81	84	"	"	"
5-8-82 0040	20	17	"	35	"	"	36	"	"	70	82	"	"	"	"
0140	"	"	"	"	"	"	37	"	"	"	"	"	"	"	"
240	"	"	"	36	"	"	36	"	"	71	"	85	"	"	"
340	"	16	"	35	"	"	"	31	"	"	"	"	"	"	"
440	"	17	"	36	"	"	"	"	"	"	"	"	"	"	"
540	20	"	27	35	"	"	37	32	51	"	"	"	"	"	"
640	"	"	23	"	"	43	36	"	"	"	"	"	"	"	"
740	"	"	"	"	"	"	"	31	"	70	"	"	"	"	"
840	21	19	25	36	37	"	37	32	50	66	80	82	"	"	"
940	25	27	28	37	"	45	43	34	"	61	77	28	63	"	"
1040	26	24	34	36	35	36	40	32	56	59	79	73	68	0	0
1140	27	25	"	"	32	37	"	"	55	56	77	69	"	"	"
1240	"	26	"	"	"	"	39	31	52	55	76	"	67	"	"
1340	26	24	"	35	31	34	38	35	57	57	78	76	"	"	"
1440	"	"	33	34	30	35	"	30	"	54	77	71	"	"	"
1540	25	23	"	"	"	34	37	"	55	"	75	68	"	"	"
1640	24	22	35	35	29	32	36	28	"	56	76	70	"	"	"
1740	22	21	26	33	33	40	39	30	53	64	79	81	63	"	1
1840	21	20	25	34	34	"	"	"	"	67	81	83	64		"
1940	22	21	"	"	"	"	35	31	54	64	"	"	"		"
2040	20	19	24	"	"	"	"	"	52	66	"	"	"		"
2140	20	18	"	"	"	"	37	"	51	67	"	"	"		"
2240	"	"	"	33	"	"	"	"	52	68	82	84	"		"
2340	20	"	"	34	39	42	35	35	57	"	81	83	"		"
0040	"	"	"	"	35	41	36	"	"	70	"	"	"		"

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24-7-82	RA	ERA	WS				SA		SA	RA		FRA			
			WT SURF	MAT	MT OFF	LITTON		MAT			WT SURF		DANGER	CONT	TOTAL
0100	23	18	24	37	37	43	38	33	53	77	85	88	64	1	1
200	"	"	"	36	"	"	"	"	"	78	"	89	"	"	"
300	"	"	"	37	38	44	"	"	"	"	82	"	"	"	"
400	20	"	"	"	"	"	"	"	"	79	"	90	"	"	"
500	"	17	23	"	37	43	"	"	"	"	"	"	"	"	"
600	"	"	24	35	"	44	"	"	"	80	78	"	"	"	"
700	"	"	23	"	"	"	"	"	54	"	87	91	"	"	"
800	23	18	24	"	38	"	"	"	"	"	"	"	"	"	"
900	21	20	25	37	"	"	"	34	"	77	85	89	"	"	"
1000	22	21	26	"	39	43	"	"	"	76	85	88	"	"	"
1100	23	22	27	"	38	44	39	"	55	75	84	87	63	0	1
1200	24	(27)	28	"	39	43	"	"	"	73	"	85	"	"	"
1300	"	"	"	"	37	44	43	"	"	"	83	"	"	"	"
1400	"	22	27	"	38	"	39	"	"	75	84	87	"	"	"
1500	25	24	28	"	"	42	43	"	"	73	83	86	"	"	"
1600	"	"	33	36	33	35	40	32	60	71	"	82	68	0	0
1700	"	23	34	35	31	39	"	31	61	"	"	83	"	"	"
1800	22	21	26	"	36	43	37	33	57	76	87	89	63	1	1
1900	"	"	"	36	"	"	38	"	"	75	86	"	64	"	"
2000	"	20	26	"	37	"	"	"	56	77	"	"	"	"	"
2100	"	"	"	"	"	44	"	"	57	79	88	91	"	"	"
2200	27	22	27	37	38	"	39	34	58	77	"	"	"	"	"
2300	22	21	26	"	"	45	"	"	57	79	89	92	"	"	"
0000 25-7-82	21	20	"	"	"	44	38	"	"	80	88	"	"	0	1
0100	"	"	"	36	37	"	"	33	56	"	"	"	"	"	"
200	"	"	"	"	38	45	37	34	"	"	"	91	"	"	"
300	20	"	25	"	39	42	38	"	"	"	"	"	"	"	"
400	"	19	"	"	38	44	"	33	52	79	"	"	"	"	"
500	"	23	"	"	"	45	39	"	"	"	"	"	"	"	"
600	"	17	"	"	34 43	42	38	34	"	80	"	92	"	"	"
700	"	"	24	"	38	44	"	33	55	"	"	"	"	"	"
800	"	18	24	"	"	45	"	"	"	"	"	"	"	"	4
900	"	"	25	"	"	44	"	"	"	"	87	91	"	"	"
1000	22	21	26	"	39	"	"	"	56	78	"	90	"	"	"
1100	23	22	27	"	"	"	"	34	"	76	85	88	63	"	"
1700	24	23	28	"	38	45	39	"	"	73	84	86	"	"	"
1300	"	"	"	37	"	44	"	"	"	"	"	"	"	"	"
1400	25	24	30	"	37	40	40	33	"	72	91	85	68	0	0
1500	24	22	33	35	37	39	30	60	58	60	83	83	"	"	"
1600	"	23	35	34	31	36	38	30	61	74	83	84	"	"	"
1700	22	21	26	35	35	42	37	33	57	76	86	88	63	1	1
1800	21	"	"	"	36	43	"	32	"	"	87	89	"	"	"
1900	22	"	"	"	37	"	"	33	52	74	86	"	64	"	"
2000	"	22	"	"	"	"	"	"	55	72	84	87	"	"	"
2100	"	21	"	"	"	"	38	"	"	"	"	"	"	"	"
2200	21	"	"	37	"	44	37	32	54	71	"	"	"	"	"
2300	20	19	24	"	"	43	"	33	53	72	85	88	"	"	"
0000	20	18	"	34	38	44	"	32	"	74	86	89	"	"	"

11-6-82	RA BOEA	FRA AIR AIR	WA WSURF	MAR	WCCFE	WTCH	SA LEV AIR	MET	SA LEV AIR	FRA AIR AIR	WA WESUE	RA ROEN	UAMP	1 CCHP	2 PUMP
0154	20	23	25	36	37	43	39	33	54	76	85	89	64	1	1
254	"	19	24	"	38	"	"	"	"	"	"	"	"	"	"
354	"	"	"	"	"	"	"	"	"	78	86	90	"	"	"
454	19	18	"	"	37	"	"	"	"	77	"	"	"	"	"
554	"	"	23	"	38	"	38	"	"	"	"	"	"	"	"
654	18	17	27	"	"	"	"	32	"	"	"	"	"	"	"
754	"	"	22	39	37	"	"	"	"	76	"	"	"	"	"
854	20	20	25	36	38	"	"	33	"	73	85	88	"	"	"
954	22	22	26	37	"	"	43	"	"	71	83	86	"	"	"
1054	24	24	27	36	"	44	"	"	"	68	81	84	63	"	"
1150	23.5	23.0			37	41.5	34		39	59		57			
1154			28	37	37	43	39	34	"	67	"	82	64	"	"
1254	25	24	"	"	"	44	40	35	52	66	79	80	63	"	"
1354	"	25	29	"	38	45	"	34	53	67	80	82	"	"	"
1454	"	24	33	36	35	34	41	"	60	68	82	80	68	0	0
1554	27	22	27	37	37	44	43	33	53	70	80	82	63	1	1
1654	25	24	28	"	"	"	39	34	54	68	81	83	"	"	"
1754	23	22	27	"	38	"	"	"	55	71	83	86	64	"	"
1854	22	21	26	"	"	43	43	"	54	72	84	87	"	0	1
1954	21	20	"	36	"	"	"	33	"	73	"	"	"	1	1
2054	"	"	25	"	"	44	43	"	"	"	"	"	"	"	"
2154	22	22	26	"	"	"	39	34	"	70	83	85	"	"	"
2254	23	23	27	"	"	"	43	"	"	69	82	84	"	"	"
2354	21	19	25	"	37	43	39	33	"	73	84	87	"	"	"
0054	20	"	"	"	38	44	38	"	"	76	86	88	"	"	"
12-6-82 0154	"	"	"	"	"	"	39	"	55	78	"	89	"	"	"
254	19	23	24	"	"	"	"	32	"	"	"	80	"	"	"
354	20	"	"	35	"	"	"	33	52	80	87	91	"	"	"
454	"	"	"	"	37	"	38	"	"	81	88	"	"	"	"
554	23	18	"	39	"	43	"	32	55	79	87	"	"	"	"
654	19	"	"	"	"	"	"	"	"	80	"	"	"	"	"
754	"	"	"	35	"	"	"	"	"	79	"	"	"	"	"
854	20	19	"	39	"	44	"	33	"	78	"	90	"	"	"
954	"	20	25	35	38	42	"	32	"	75	85	88	4	0	1
1054	21	"	"	"	37	44	"	33	54	72	84	87	63	1	1
1154	22	"	26	"	"	"	"	"	52	65	81	84	"	"	"
1215	19	20			39	42	33		38	59		63		14.5	11.
1254	22	22	27	37	37	43	39	"	53	68	80	84	63	"	"
1354	23	"	26	"	36	44	"	"	54	73	83	86	"	"	"
1454	22	21	"	35	37	44	40	34	53	70	82	"	"	"	"
1554	"	"	"	37	"	"	"	"	52	69	81	84	"	"	"
1654	20	20	25	"	"	"	39	33	53	76	83	87	64	"	"
1754	"	19	24	"	"	43	43	"	"	75	84	88	"	"	"
1854	19	"	"	"	"	"	"	"	52	79	88	92	"	"	"
1954	21	21	25	"	"	44	39	34	55	75	86	90	"	"	"
2054	"	"	"	"	"	43	"	33	54	72	84	88	"	"	"
2154	"	20	24	36	36	"	43	"	53	"	"	87	"	"	"
2254	20	21	25	37	37	"	39	"	"	71	83	86	"	"	"
2354	"	"	"	36	"	44	43	"	"	"	"	"	"	"	"
0054	21	"	"	"	"	43	39	34	54	72	"	"	"	"	"

29-5-82	RA	FRA	WS	MET	WT OFF	WT ON	SA	MET	SA	RA	WS	FRA	DAMP
0125	21	19	27	29	28	33	27	26	66	70	79	80	64
225	"	23	26	30	29	34	28	"	67	71	80	81	"
325	"	19	23	"	"	"	"	27	68	74	81	82	"
425	20	23	24	31	"	35	"	"	69	"	82	83	"
525	21	"	"	32	30	36	29	28	"	75	"	84	"
625	20	"	23	"	31	37	"	"	70	76	83	85	"
725	21	"	24	33	32	35	30	29	71	77	"	86	"
825	"	19	"	"	33	43	"	"	72	79	84	87	"
925	"	"	"	34	"	40	35	31	73	81	85	88	"
1025	23	22	26	36	34	41	32	32	72	79	"	87	63.
1125	24	"	32	35	32	33	24	30	76	81	"	86	69.
1225	21	20	26	33	34	40	31	"	78	85	84	90	63.
1325	23	21	"	35	35	41	35	32	75	81	87	89	"
1425	"	"	27	36	"	42	32	33	74	79	86	89	"
1525	"	"	26	"	36	"	33	"	72	74	84	87	"
1625	"	"	"	37	"	43	34	"	"	76	"	"	"
1725	22	"	"	"	37	"	33	"	73	77	86	89	64
1825	21	20	25	"	"	"	"	"	74	78	87	90	"
1925	"	19	"	"	38	"	"	"	75	77	88	91	"
2025	22	21	26	"	"	"	"	"	"	75	87	"	"
2125	"	"	"	"	37	44	"	34	73	73	85	88	"
2225	22	"	"	36	38	43	"	33	72	74	"	"	"
2325	20	23	25	"	37	"	32	"	73	76	86	89	"
0025	"	19	"	"	38	"	33	"	74	"	87	90	"
4-6-82 0125	"	"	24	"	"	"	32	"	"	77	"	"	"
225	23	18	"	"	"	"	"	32	"	"	"	"	"
325	25	"	"	35	37	"	31	33	73	"	86	"	"
425	"	"	23	"	"	42	32	32	74	"	"	"	"
525	"	17	"	39	"	43	"	"	"	"	87	"	"
625	"	"	27	"	"	42	"	"	"	"	"	"	"
725	"	"	"	35	"	43	31	"	"	"	"	91	"
825	20	19	24	39	38	"	32	"	"	78	86	90	"
925	20	19	25	35	37	"	"	"	73	77	"	89	"
1025	21	"	"	36	"	"	33	33	"	"	"	"	63.
1125	24	22	30	35	35	41	24	34	75	96	90	86	68
1225	25	23	35	34	34	35	"	31	73	75	84	84	"
1325	26	25	"	35	35	36	26	"	72	74	"	83	"
1425	"	24	33	34	30	34	"	"	70	73	83	81	"
1525	"	"	"	33	14	30	"	28	"	72	81	"	"
1625	23	21	35	34	27	33	23	29	73	76	82	84	"
1725	22	20	31	33	28	35	22	28	75	78	83	85	"
1825	27	22	"	"	26	31	27	"	"	26	"	"	"
1925	23	23	30	"	"	29	24	"	73	78	"	84	"
2025	"	"	31	"	25	"	"	"	72	74	82	82	"
2125	27	22	30	32	"	"	27	27	73	75	83	83	"
2225	24	27	"	35	"	"	24	28	70	72	82	81	"
2325	"	"	"	32	24	"	"	27	69	23	"	"	"
0025	21	20	29	35	"	28	21	26	73	27	"	83	"

	RA ~~EQ~~	RET AIR	WT SUPP	NET	WT OFF	WT ON	EGG WEB	NET	~~WET~~ AIR	RET AIR	WT SUPP	RA ~~EQ~~	DAMP	
	RA	FRA	WA				SA		SA	FRA	WA	RA		
10-5-82														
1716	21	21	35	35	25	38	22	28	65	60	50	69	68	
1816	23	22	"	33	~~25~~ 30	~~25~~ 30	~~23~~ 30	~~29~~ 28	69	61	55	74	"	
1916	"	23	32	35	24	30	23	28	65	54	53	69	"	
2016	24	21	31	33	"	29	"	"	58	46	49	62	"	
2116	23	22	35	"	"	"	24	"	56	51	47	60	69	
2216	24	"	30	"	23	"	27	27	55	"	46	58	68	
2316	21	20	"	35	27	"	22	"	59	54	48	62	"	
11-5-82 0016	"	19	24	32	"	36	30	29	55	"	49	67	64	
116	"	20	"	"	"	"	29	"	57	59	52	70	64	
216	"	"	"	34	28	38	30	30	59	63	54	73	"	
316	"	19	"	"	29	43	31	"	60	"	55	74	"	
416	"	"	27	"	30	37	35	35	59	62	"	"	"	
516	"	"	24	35	29	43	"	31	60	63	56	76	"	
616	20	"	"	"	31	40	"	35	"	"	"	77	"	
716	"	"	"	29	"	"	31	31	"	"	57	"	"	
816	"	"	"	39	35	41	32	32	61	62	58	78	"	
~~10~~ 916	"	20	25	"	32	"	"	"	62	69	59	80	"	
1016	22	22	26	36	33	"	33	33	"	67	"	79	"	
1116	24	23	33	37	32	34	24	32	67	59	57	72	68	AND 14, 13
1216	24 21.5	27 21.0	35	35	27 30	31 34	27 24	31	58 63	64 61	53	65 68	"	908
1316	22	20	34	"	29	"	22	"	64	56	50	"	"	
1416	"	19	32	34	"	"	"	30	60	57	48	64	"	
1516	21	20	35	"	28	33	"	29	"	56	"	"	"	
1616	"	"	25	"	34	38	35	31	55	"	46	66	63	
1716	22	"	26	39	31	39	32	35	57	58	52	71	"	
1816	20	23	25	35	32	40	"	34	58	62	54	74	64	
1916	23	22	"	"	35	"	33	32	57	55	52	71	"	
2016	"	"	27	36	34	"	"	33	58	"	53	72	"	
2116	"	"	"	37	"	41	34	34	56	54	51	70	"	
2216	"	23	30	"	32	37	24	32	62	"	64	68	69	
2316	22	21	33	36	29	34	22	30	65	59	53	70	68	
0016	20	20	25	35	33	41	32	32	59	60	55	75	64	

19-4-82	RA	FRA	WS	HAT	WIOFF	WICK	SA	MIC	SA	RA	WS	FRA	CHAMPER	
0157	20	19	23	30	–	–	27	27	67	65	75	74	64	
257	"	23	24	"	–	–	28	28	"	68	"	75	"	
357	"	19	27	"	–	–	"	"	69	64	73	72	"	
457	"	"	23	32	–	–	"	29	69	63	"	"	"	
557	19	"	27	"	–	–	30	"	64	69	70	75	57	
657	20	"	23	"	–	–	29	"	"	68	69	"	"	
757	21	20	24	33	–	–	30	"	"	66	70	76	59	
857	25	23	32	35	–	–	24	24	62	61	63	67	62	
957	26	25	33	32	–	–	26	27	58	60	56	64	60	
1057	27	27	30	34	–	–	32	35	"	50	61	65	61	AMB 20.13
	25.5	26			32	27	29.5		42	40		42		45
1157	29	28	31	35	–	–	35	28	57	44	"	60	62	
1257	28	26	28	29	–	–	28	26	61	49	63	65	61	
1357	29	29	29	27	–	–	29	24	58	52	61	62	57	
1457	27	26	28	26	–	–	26	22	63	46	63	65	61	
1557	26	25	26	24	–	–	25	20	62	51	65	62	"	
1657	25	24	25	22	–	–	27	18	60	55	64	61	"	
1757	27	20	21	21	–	–	23	"	64	54	74	67	67	
1857	22	"	20	20	–	–	21	17	68	60	77	71	68	
1957	"	"	"	19	–	–	22	"	63	61	76	67	"	
2057	"	19	21	23	–	–	"	"	62	67	71	68	61	
2157	27	22	20	20	–	–	23	18	66	56	"	66	67	
2257	22	21	"	"	–	–	22	17	62	55	72	"	68	
2357	21	20	21	23	–	–	20	19	63	"	68	64	63	
0057	"	"	"	20	–	–	21	17	61	62	63	67	57	
20-4-82														
0158	"	23	"	23	–	–	22	19	"	53	66	66	63	
258	"	"	22	24	–	–	23	20	"	60	65	69	"	
358	20	"	"	25	–	–	"	21	63	55	"	"	64	
458	21	"	23	26	–	–	25	27	60	65	66	68	59	
558	"	19	"	27	–	–	26	24	64	58	67	70	63	
658	20	"	"	28	–	–	"	25	58	61	66	66	61	
758	21	20	24	30	–	–	28	26	60	62	63	69	57	
858	23	21	25	31	–	–	29	28	61	58	70	67	63.	
958	24	22	31	30	–	–	24	25	60	62	64	65	67	
1058	28	26	29	32	–	–	35	29	53	50	60	58	62	
	24.5	24.5			32	26	28.5		40	40		40		
1158	29	28	30	31	–	–	30	27	56	54	59	61	57	
1258	28	26	29	28	–	–	28	24	57	52	61	59	61	
1358	28	"	28	26	–	–	27	22	58	56	58	62	55	
1458	"	25	27	24	–	–	25	20	61	51	61	63	61	
1558	27	26	31	27	–	–	24	19	65	57	64	67	"	
1658	26	25	25	22	–	–	23	17	69	66	69	71	56	
1758	25	23	24	20	–	–	21	16	71	56	70	70	61	
1858	23	21	20	"	–	–	27	18	61	64	75	67	"	
1958	"	"	19	"	–	–	22	17	64	56	79	"	68	
2058	22	20	18	19	–	–	"	"	59	63	73	65	60	
2158	"	21	19	"	–	–	"	"	58	59	75	63	68	
2258	21	20	23	23	–	–	"	"	65	63	76	71	"	
2358	"	"	19	19	–	–	"	16	63	66	77	67	66	
0058	22	"	"	"	–	–	21	"	65	60	76	69	68	

17-4-82	RIZ FR FRA	RAT DIE RA	WT SCALE WS	MRC	WT OFF	WT ON	LEV AIR SA	MRC	LEV AIR SA	RIZ AIR RA	WT SCALE WS	RO FD FRA	DAMPER	
0157	20	23	25	34	—	—	30	35	61	58	68	73	64	
257	"	"	24	"	—	—	"	31	62	61	69	75	"	
357	"	20	23	"	—	—	"	"	63	63	68	"	59	
457	"	"	24	33	—	—	"	34	62	57	70	73	64	
557	"	"	25	34	—	—	31	31	60	62	72	72	"	
657	"	23	24	"	—	—	"	—	61	60	"	71	"	
757	"	19	"	35	—	—	35	32	62	64	69	75	57	
857	20	23	26	36	—	—	32	"	"	58	67	73	63	
957	"	22	27	"	—	—	35	33	59	60	66	69	58	
1057	24	"	"	"	—	—	33	35	"	51	67	67	63	
1157	"	23	34	34	—	—	25	28	57	60	57	64	62	AMB 18.12
	21	21			30	26.5	21		46	46		62		499
1257	25	24	35	35	—	—	24	"	"	47	55	60	67	
1357	24	"	39	33	—	—	"	27	"	49	54	62	"	
1457	26	26	30	35	—	—	33	35	56	52	57	65	57	
1557	25	27	31	33	—	—	29	29	62	55	63	70	61	
1657	29	24	25	28	—	—	28	26	"	59	64	"	56	
1757	22	20	28	26	—	—	21	21	64	54	63	68	67	
1857	23	22	24	27	—	—	27	25	62	52	64	"	63	
1957	27	"	25	29	—	—	"	26	60	45	63	64	64	
2057	"	23	"	30	—	—	28	27	55	"	62	60	"	
2157	24	"	26	35	—	—	29	28	59	44	"	63	"	
2257	22	21	24	"	—	—	28	"	61	51	63	69	"	
2357	21	20	23	31	—	—	29	27	60	58	71	"	"	
0057	20	20	"	35	—	—	28	28	58	64	62	71	58	
18-4-82 0157	"	23	27	32	—	—	29	"	61	68	69	73	"	
257	23	21	23	"	—	—	28	29	66	"	76	76	"	
357	18	19	27	"	—	—	29	"	67	67	72	78	64	
457	20	19	24	33	—	—	30	30	65	68	74	74	"	
557	"	23	23	"	—	—	29	"	"	69	72	79	63	
657	"	"	24	32	—	—	35	"	64	73	74	78	69	
757	22	22	26	34	—	—	"	31	"	62	75	73	64	
857	25	24	33	33	—	—	25	27	63	"	64	67	68	
957	26	25	34	"	—	—	"	26	64	55	62	66	"	
1057	"	24	"	35	—	—	"	27	"	"	59	68	"	
1157	28	31	29	33	—	—	32	30	58	57	61	66	56	AMA 18.13
	24.5	25.5			34.5	28	30.5		43	45		49		578
1257	25	24	27	31	—	—	29	27	64	69	69	74	57	
1357	"	25	"	28	—	—	28	24	67	68	68	73	52	
1457	"	24	26	26	—	—	25	22	74	64	78	77	61	
1557	26	"	"	24	—	—	"	21	68	69	71	72	57	
1657	24	22	23	23	—	—	24	20	72	65	76	75	67	
1757	22	21	24	21	—	—	22	23	71	68	72	76	"	
1857	20	20	21	22	—	—	"	"	67	-	73	71	62	
1957	"	23	"	23	—	—	21	20	68	60	"	73	64	
2057	22	22	23	25	—	—	24	21	"	67	75	"	62	
2157	23	23	24	26	—	—	26	24	67	60	"	72	64	
2257	"	17	"	28	—	—	"	25	65	"	74	"	"	
2357	21	20	22	"	—	—	"	"	70	66	72	76	"	
0057	"	23	"	"	—	—	27	26	65	73	75	77	61	CONT'D

28-3-82	RA	FKA	WA	HUT	WT OFF	WT ON	SA	HUT	SA	FKA	WA	RA	DRAUGHT	
0148	22	20	26	36	38	41	32	32	24	72	81	83	64	
248	"	"	"	"	"	"	"	33	76	75	82	85	"	
348	"	"	"	"	39	42	"	32	77	81	"	82	63	
448	21	"	"	"	43	"	33	34	74	79	83	84	64	
548	"	"	"	"	"	"	"	33	75	73	"	85	"	
648	22	"	25	37	40	"	"	"	"	81	80	87	59	
748	"	21	26	36	"	"	34	34	"	78	83	84	63	
848	23	"	28	37	"	43	33	"	"	71	80	"	"	
948	25	22	"	"	41	42	34	"	70	68	78	79	"	
1048	23	22	34	35	34	39	24	27	71	78	72	77	61	
1148	25	24	36	33	29	29	26	27	~~66~~	72	72	72	67 ~~66~~	
1248	25	27	"	32	26	26	25	28	75	70	72	79	67	
1348	26	23	"	33	"	25	"	"	67	65	72	70	"	
1448	25	24	"	31	25	25	26	27	69	71	68	25	60	
1548	25	24	39	35	26	"	"	"	68	61	69	71	67	
1648	"	"	35	30	25	24	"	26	67	63	71	70	"	
1748	22	21	34	29	23	27	24	"	70	76	68	76	60	
1848	23	20	33	"	21	21	23	24	72	70	69	77	67	
1948	"	21	26	33	34	37	30	30	69	68	77	76	63	
2048	"	"	"	"	39	38	"	"	74	71	78	82	"	
2148	"	22	"	34	36	40	35	35	71	73	80	80	"	
2248	22	"	"	35	37	41	31	"	72	72	81	81	"	
2348	23	21	"	"	38	40	32	"	74	69	80	83	"	
0048	23	22	"	36	"	42	33	33	72	77	77	84	57	
29-3-82 0148	22	21	"	35	"	"	32	32	69	"	78	81	59	
248	"	"	"	36	"	43	33	33	71	79	"	83	58	
348	"	"	27	"	"	44	"	"	72	77	76	84	57	
448	"	"	26	37	39	43	"	34	71	76	80	81	63	
548	"	"	"	"	40	"	"	"	74	"	79	85	"	
648	"	"	27	"	39	44	32	"	76	72	81	85	"	
748	23	"	"	36	43	45	33	"	71	71	79	83	"	
848	24	22	"	37	40	43	"	"	73	70	80	82	"	
948	25	23	33	34	38	39	25	28	80	75	82	85	68	
1048	24	"	36	33	28	33	24	31	76	71	76	80	67	
1148	25	"	37	34	27	31	"	28	73	75	71	79	60	
1248	25	"	36	34	26	30	25	27	73	66	72	78	67	
1348	26	24	35	33	"	28	"	28	"	63	"	76	"	
1448	25	"	36	38	25	"	"	27	65	64	69	69	"	
1548	"	"	39	32	26	27	26	"	63	"	67	68	64	
1648	"	27	35	35	24	"	25	26	72	60	71	75	67	
1748	24	21	34	30	27	25	23	25	67	74	70	75	62	
1848	27	"	26	32	33	38	30	30	"	62	69	74	63	
1948	"	"	27	33	34	39	31	"	64	66	70	76	"	
2048	"	22	26	34	36	40	"	31	68	"	73	78	"	
2148	"	"	"	35	37	41	35	35	69	64	75	"	"	
2248	23	"	27	"	36	42	32	32	66	74	74	78	58	
2348	27	22	"	39	38	"	"	35	70	65	76	29	63	
0049	"	"	"	35	"	43	33	33	65	72	72	77	57	

18-11-81	RA	FRA	WS	SA					RA	FRA	WS	SA		
0142	23	18	27	35	43	42	31	31	66	82	73	81	60	
0247	23	19	24	39	38	41	31	31	70	74	83	76	64	
0347	26	18	23	34	43	41	30	35	66	79	80	77	63	
0447	26	18	23	35	39	42	30	31	77	75	81	83	64	
0547	26	18	27	34	38	41	29	31	69	78	83	77	"	
0647	26	18	22	33	38	41	30	31	73	78	76	87	"	
0747	21	20	24	35	39	42	32	31	62	75	80	72	63	
0847	23	20	26	36	39	43	33	33	66	78	72	80	"	
0947	23	21	35	35	39	37	22	26	69	55	76	70	68	
1047	25	23	36	33	38	36	23	26	54	53	76	59	67	
1147	24	23	39	34	35	35	24	26	53	66	65	61	63	
1247	26	25	28	35	38	35	33	35	53	69	69	64	59	
1347	27	25	28	31	34	29	30	29	56	67	77	61	61	
1447	27	26	28	30	31	26	29	26	57	67	79	61	"	
1547	26	25	28	28	28	22	27	24	60	70	81	63	"	
1647	26	25	27	26	25	20	26	22	63	69	83	63	"	
1747	25	23	24	27	22	18	24	19	72	71	64	73	"	
1847	24	22	24	22	24	21	27	20	71	84	78	77	63	
1947	22	22	24	21	21	19	22	18	69	79	73	76	64	
2047	22	20	23	26	26	20	21	17	78	102	82	75	68	
2147	21	19	22	21	20	24	21	18	80	"	83	77	64	
2247	20	19	21	25	22	25	22	19	77	"	84	74	"	
2347	21	20	21	24	23	27	24	21	70	"	79	74	60	
0047	20	19	22	25	25	29	23	22	71	"	73	77	59	

0-11-81	RA	FRA	WS	SA	WT OFF	WT ON	MLT	MLT	RA	FRA	WS	SA	PUMPED
0145	20	23	24	34	36	39	30	30	60	70	79	68	64
0245	20	23	24	34	36	39	30	30	63	68	80	71	"
0345	20	23	24	33	37	40	30	30	64	70	81	72	"
0445	20	18	24	34	37	41	30	30	66	65	79	74	"
0545	20	18	24	34	37	41	31	30	65	76	71	81	62
0645	20	23	24	34	38	41	30	31	62	75	79	71	64
0745	20	23	24	34	38	41	35	35	68	75	73	82	"
0845	21	19	25	35	39	41	32	31	61	75	78	71	63
0945	21	20	25	35	43	43	32	32	63	79	71	76	57
1045	27	21	27	34	39	42	33	33	61	78	69	75	"
1145	22	20	34	35	33	38	21	25	69	75	72	79	68
1245	25	22	39	38	34	36	24	26	61	60	76	64	67
1345	25	24	35	36	38	36	25	27	54	63	68	62	63
1445	25	23	35	34	36	36	24	26	60	53	71	65	67
1545	26	24	35	39	35	34	25	26	47	57	63	58	63
1645	26	27	35	35	34	34	25	26	44	56	62	54	67
1745	24	22	35	34	32	33	24	25	45	50	70	53	66
1845	21	20	34	33 35	35 30	30 22	22	23	56	59	72	63	65
1945	22	20	34	32	35	30	21	27	66	58	84	67	68
2045	22	20	25	36	34	37	29	28	58	74	66	70	59
2145	21	20	24	33	35	37	30	29	59	74	73	70	60
2245	19	20	24	33	36	38	29	29	65	66	79	71	64
2345	20	20	27	33	36	38	29	29	67	71	72	79	"
0045	20	19	23	32	36	39	30	30	62	79	74	75	61

11-11-81	RA	FRA	WS	SA					RA	FRA	WS	SA	
0145	20	19	24	39	35	41	32	31	74	58	81	86	60
0245	20	19	24	39	39	42	35	31	80	80	81	80	64
0345	20	23	25	35	38	41	31	31	67	80	83	77	"
0445	19	23	24	35	43	42	31	32	71	80	85	79	"
0545	20	19	24	39	39	42	32	32	73	82	76	88	"
0645	20	19	24	35	43	42	31	31	65	83	79	80	61
0745	21	20	25	37	39	42	32	32	67	72	82	75	64
0845	22	20	26	36	39	43	31	32	65	77	72	81	62
0945	21	21	26	36	40	43	33	33	62	71	72	78	63
1045	22	21	26	36	40	43	33	33	65	70	73	77	"
1145	23	21	39	36	30	38	23	26	55	62	67	68	64
1245	24	22	36	38	28	35	23	26	63	60	63	61	68
1345	23	21	36	35	26	35	23	25	54	61	66	65	66
1445	24	22	36	39	25	30	24	26	62	60	75	58	67
1545	26	27	36	35	26	28	25	26	54	64	66	61	63
1645	25	24	39	34	26	28	26	26	58	52	73	59	67
1745	24	27	39	34	25	27	24	25	52	62	73	58	66
1845	24	22	35	32	23	26	23	24	56	61	68	64	64
1945	22	19	34	32	22	25	22	22	60	66	67	65	63
2045	20	19	24	35	34	37	27	27	56	70	72	65	"
2145	20	19	24	32	34	38	29	29	62	67	79	68	"
2245	20	23	24	33	35	38	29	29	68	71	75	79	64
2345	20	23	24	33	35	43	29	30	65	75	72	79	"
0045	21	19	24	33	36	39	30	30	61	69	80	68	"

1-11-81	RA	FRA	WS	SA	WT OFF	WT ON	MET	MET	BEF AIR RA	FRA	WS	SA		
									70	95	0'2	23	65	
0140	22	20	18	18	18	15	21	16						
0240	21	19	20	15	15	18	23	15	66	81	85	70	62	
0340	20	20	21	20	17	20	20	16	74	77	80	80	64	
0440	20	20	21	~~21~~ 19	~~19~~ 17	27	~~21~~ 18	18	67	80	73	75	59	
0540	20	19	21	23	21	25	22	19	68	78	73	77	60	
0640	20	20	21	24	24	26	23	21	62	78	77	70	"	
0740	21	20	22	25	25	29	25	22	66	78	71	74	59	
0840	21	20	27	27	27	31	25	24	65	77	80	70	63	
0940	22	21	24	28	29	33	27	25	70	67	77	72	"	
1040	23	21	26	29	31	34	28	26	61	76	73	69	60	MAX 18.8
1140	23	21	29	30	27	31	23	22	63	68	65	69	65	MIN 14.3
1240	27	22	30	30	30	29	23	23	59	66	70	61	"	
1340	23	22	30	29	30	29	24	22	52	59	75	54	67	
1440	24	23	29	35	30	28	24	24	56	55	65	61	"	
1540	23	22	30	29	28	28	24	23	58	60	65	64	"	
1640	23	22	30	29	28	28	24	23	52	~~55~~ 74	~~53~~ 74	53	"	
1740	23	22	30	28	27	27	23	22	53	58	76	52	"	
1840	27	22	29	28	27	27	23	22	59	56	77	59	"	
1940	21	20	29	28	26	25	21	20	64	66	70	63	64	
2040	21	20	23	29	28	32	26	25	52	63	73	56	"	
2140	20	20	23	29	30	35	26	26	59	59	71	62	"	
2240	20	19	27	30	31	34	27	26	63	61	71	66	"	
2340	20	19	23	30	32	34	28	27	55	67	69	63	62	
0040	20	19	25	35	33	36	28	28	63	65	64	72	64	

27-10-81	RSCAIR	MAINCH	WT SUAR	HURSLEY										
	RA	FRA	WS	SA					RA	FRA	WS	SA		
0437	27	24	21	20	20	19	23	19	64	78	80	61	62	
0537	25	23	20	21	17	18	24	19	71	82	77	71	4	
0637	24	23	20	20	19	18	24	17	64	92	76	69	63	
0737	24	22	20	20	19	17	23	19	71	89	76	77	67	
0837	23	23	20	20	19	18	24	18	67	86	84	67	"	MAX 87.7
0937	27	22	19	20	19	17	23	18	62	90	79	65	64	MIN 17.2.
1037	22	21	20	19	20	17	22	17	67	92	80	73	63	
1137	22	20	20	20	19	17	23	17	65	90	82	69	67	
1237	21	20	20	19	18	20	20	18	75	86	91	76	62	
1337	20	20	21	20	18	21	20	16	70	82	86	74	63	
1437	20	18	21	22	20	23	21	18	73	86	80	81	59	
1537	21	21	27	23	22	25	23	20	74	84	78	82	"	
1637	27	22	24	25	26	26	23	21	71	84	76	78	64	
1737	27	21	25	25	28	28	22	19	73	80	77	80	67	
1837	22	20	26	24	27	21	21	19	70	71	86	76	68	
1937	20	19	22	25	23	28	24	21	66	78	71	75	59.	
2037	19	18	22	26	25	28	23	22	70	71	83	71	64	
2137	19	20	21	27	26	30	25	27	76	72	77	79	"	
2237	21	19	27	27	28	32	26	24	78	73	78	80	"	
2337	20	19	23	29	29	33	26	25	67	78	79	73	62	
0037	20	23	23	30	30	34	27	26	70	82	74	77	59	
28-10-81														
0137	23	19	22	30	32	35	27	26	66	79	76	76	60	
0237	20	18	21	31	32	36	27	27	70	83	74	80	59	
0337	19	18	22	31	33	37	27	27	69	83	74	80	"	

19-10-81	REC AIR RA	RA/FA FRA	WT SURF WS	[illegible] SA	WT OFF	WT ON	HRT	HRT	REC AIR RA	[illegible] FRA	WT SURF WS	LIV AIR SA	DIMMER	
0434	20	18	23	33	37	40	30	30	57	71	20	66	62	
0534	20	20	22	33	37	40	30	30	59	66	77	65	64	
0634	20	19	24	33	37	40	30	31	61	69	66	73	"	
0734	21	20	25	34	37	40	35	35	59	64	75	64	63.	
0834	22	21	32	35	39	39	23	25	58	79	76	59	68	BY PASS
0934	25	22	34	34	37	38	24	25	57	69	70	62	67	
1034	24	23	37	34	36	35	25	26	44	49	58	43	"	
1134	28	25	29	33	36	31	32	30	47	53	62	52	61	
1234	27	26	29	35	33	28	31	28	57	53	58	43	59	FALLOPIAN
1334	28	26	29	29	30	25	29	26	39	54	68	43	58	
1434	29	27	29	27	31	22	28	24	41	46	68	36	61	MAX 26.5
1534	29	25	28	25	24	19	27	22	31	48	68	36	59	MIN 12
1634	30	24	27	24	22	18	25	19	34	46	66	33	61	
1734	26	24	26	22	20	19	27	19	31	46	65	32	62	
1834	25	25	24	20	18	14	22	17	37	61	67	38	61	
1934	25	22	24	19	19	13	21	16	34	45	60	32	62	
2034	25	22	22	18	14	11	24	19	31	40	60	31	67	
2134	24	22	19	18	18	19	23	17	26	68	48	32	"	
2234	23	21	19	19	18	17	24	18	22	65	55	26	"	
2334	22	20	19	18	17	16	22	19	66	81	71	67	"	
0034	21	20	19	18	18	15	21	19	73	95	84	75	"	
19-10-81 0134	21	19	19	19	14	18	18	14	79	81	88	79	63	
0234	20	18	20	18	16	23	19	19	74	77	91	73	"	
0334	20	16	20	19	18	21	20	16	73	82	89	74	64	

8-10-81	FRA	RA	WS	SA					FRA	RA	WS	SA		
1611	30	27	35	35	32	31	35	28	25	45	55	33	59	
1511	30	27	35	29	29	24	29	26	11	34	53	22	61	MAX 27.8 MIN 8.6
1611	29	26	30	31	26	22	28	25	19	38	49	28	58	
1711	29	25	28	24	25	19	26	22	38	44	64	39	61	
1811	25	23	26	27	22	19	24	20	49	60	65	63	59	
1911	25	23	24	21	19	19	22	18	44	67	72	45	61	
2011	26	23	25	20	17	14	21	16	52	53	74	47	4	
2111	26	22	25	23	16	13	21	19	42	53	71	38	4	
2211	28	22	25	19	15	14	21	19	42	45	65	38	4	
2311	26	27	24	18	19	15	21	19	33	42	61	36	62	
0011	25	22	24	19	18	19	21	19	31	41	58	34	11	
9-10-81 0111	25	22	24	19	16	19	21	16	26	33	56	28	4	
0211	24	22	22	18	19	16	23	18	36	58	56	33	64	
0311	24	21	19	19	18	18	23	17	47	66	60	49	67	
0411	21	20	19	18	18	17	21	17	63	71	76	62	68	
0511	21	20	20	19	19	17	21	16	74	89	86	75	67	
0611	21	20	19	18	18	16	21	17	82	89	91	79	68	
0711	22	20	20	19	19	16	22	17	81	96	81	84	67	
0811	22	21	20	18	19	16	22	17	69	94	77	75	63	
0911	22	21	20	19	20	18	23	18	61	90	79	67	67	
1011	24	23	20	20	21	18	24	19	64	83	81	64	4	
1111	24	22	21	20	21	18	24	18	62	88	70	68	65	
1211	23	22	20	20	20	17	22	18	57	75	76	60	63	
1311	22	21	20	19	20	18	23	18	63	76	73	62	4	

29-9-81	RET AIR	RA/EA	WT SCRE	LEV AIR	WT OFF	WT ON	HEAT	HEAT	HUMIDITY RET AIR	HUMIDITY RA/EA	HUMIDITY WT SCRE	HUMIDITY LEV AIR	DRAINER
	RA	FRA	WA	SA					RA	FRA	WS	SA	
1511	26	24	28	32	36	15	31	29	52	60	73	57	61
1611	26	24	28	31	35	12	30	27	47	68	75	57	"
1711	26	23	26	30	34	10	28	26	48	71	74	61	"
1811	23	20	26	28	35	13	22	21	65	85	80	72	66
1911	22	20	25	27	23	19	22	21	69	81	78	75	68
2011	21	19	25	26	20	17	22	20	64	78	83	65	"
2111	22	19	26	25	23	18	22	20	68	72	79	68	"
2211	22	20	25	25	20	17	21	20	63	70	80	63	"
2311	21	23	25	24	18	18	21	18	66	68	76	66	"
0011	21	23	27	25	21	(43)	24	21	56	67	77	60	63
30-9-81 0111	21	23	23	23	25	24	23	20	56	72	71	64	60
0211	22	20	23	23	25	24	23	20	54	70	70	62	"
0311	21	23	22	23	23	24	27	20	55	66	77	58	63
0411	21	19	21	23	23	27	23	20	56	72	72	64	61
0511	20	17	21	22	23	23	22	23	58	73	71	66	60
0611	20	17	21	21	22	22	22	23	57	65	78	60	63
0711	21	20	22	22	23	22	22	19	57	62	77	58	"
0811	23	21	27	23	22	22	27	20	60	65	71	65	64
0911	24	21	24	22	24	23	24	20	57	67	73	58	67
1011	24	22	25	24	24	23	25	20	50	71	70	67	"
1111	25	22	24	24	24	24	25	21	52	73	64	56	"
1211	25	23	24	23	24	24	25	21	46	71	67	49	"
1311	25	23	24	23	24	24	25	21	56	72	67	58	"
1411	25	22	24	23	24	24	25	21	46	68	69	46	"

	RA	FRA	WS	SA					RA	FRA	WS	SA		
1511	27	25	27	20	17	17	22	19	31	42	67	31	61	
1611	28	25	27	21	17	17	22	18	32	44	64	35	"	
1711	28	25	27	21	17	19	22	17	32	40	65	35	"	
1811	28	25	20	22	19	15	24	19	30	40	57	25	"	
1911	28	25	27	21	18	13	23	19	37	39	60	31	"	
2011	28	24	26	19	19	19	21	17	31	31	59	23	62	
2111	26	24	25	23	15	16	21	19	41	54	73	40	"	
2211	26	23	25	20	17	16	21	16	47	62	71	50	61	
2311	24	23	20	20	17	18	24	19	64	91	77	68	66	
0011	27	21	20	19	18	17	23	18	74	95	81	78	68	
18-9-81														
0111	22	21	23	23	19	17	22	17	74	95	81	79	67	
0211	22	20	21	23	16	19	19	19	73	83	89	73	63	
0311	21	20	21	20	17	22	20	17	78	77	87	78	"	
0411	21	20	22	22	20	24	22	19	73	77	88	73	64	
0511	20	18	21	27	21	26	22	20	79	76	86	80	"	
0611	20	23	21	24	27	27	22	21	76	77	82	82	"	
0711	20	19	22	25	25	29	24	22	67	82	82	77	61	MAX 18.5
0811	21	21	22	27	27	35	26	23	70	86	82	80	"	MIN 13.9
0911	22	21	24	29	29	33	27	26	71	73	81	74	68	
1011	23	22	25	30	31	35	29	27	66	69	80	70	"	
1111	24	24	29	32	32	36	24	24	62	72	78	67	68	
1211	24	24	35	35	35	35	25	24	60	68	73	68	67	
1311	27	23	35	30	31	31	23	23	59	66	72	68	"	
1411	24	22	30	30	30	29	27	27	53	66	72	63	65	

12-8-81	AGT AIR 8 RA	FA/RA 1 FRA	WT SURF 9 WS	LEV AIR 3 SA	WT OFF 4	WT ON 5	MET 6	MET 7	HUMIDITY ART AIR 8 RA	HUMIDITY [illegible] 9 FRA	HUMIDITY WT SURF 10 WS	HUMIDITY LEV AIR 4 SA	DIMPLER 12	
1611	22	21	27	36	40	43	34	34	73	81	83	84	63	
1611	23	21	27	37	40	43	34	34	74	83	83	86	"	MET MAY 17 of 1345
1711	21	20	26	38	40	43	34	33	76	85	88	84	"	
1611	21	21	26	37	39	43	33	33	81	91	88	94	64	
1911	21	20	26	37	40	43	34	33	77	92	88	90	63	
2011	20	20	25	37	39	43	33	33	78 67	87 85	85	91	64	
2111	20	20	26	37	40	43	33	33	75	85	88	85	"	
2211	21	20	25	36	40	44	33	33	78	85	88	88	"	
2311	21	19	25	36	40	44	33	33	76	84	87	87	"	
18-9 0011	21	20	25	36	39	44	33	53	78	90	91	88	"	
0111	20	19	24	36	40	43	32	32	82	87	89	91	"	
0211	20	18	24	36	40	44	32	33	75	92	87	89	62	
0311	20	19	25	35	38	43	33	32	75	90	85	88	64	
0411	20	23	25	36	39	43	32	33	77	92	81	90	62	MET MAY 16-3 MIN 0.5
0511	20	19	23	35	40	43	32	32	77	87	88	87	64	
0611	20	18	24	36	43	43	32	32	79	91	84	92	"	
0711	21	23	24	35	40	43	33	32	82	92	90	96	"	
0811	21	19	25	35	40	44	33	32	82	88	89	92	"	
0911	21	20	25	36	40	44	32	33	71	89	81	85	"	
1011	21	19	25	35	40	43	33	33	74	90	84	88	63	
1111	21	20	26	35	39	39	32	32	80	87	85	91	64	
1211	22	21	26	37	40	43	35	35	78	83	85	87	"	
1311	21	20	26	37	39	42	33	35	79	87	66	91	"	
1411	22	21	26	36	40	43	33	35	76	89	81	89	63	
	20-88	20-04		36-13	39-79	41-21								

11-9-81	RAT AIR 0 RA	FA/RA 1 FRA	WT SURF 2 WS	LEV AIR 3 SA	WT OFF 4	WT ON 5	MAT 6	MET 7	REL HUM 8 RA	9 FRA	WT SURF 10 WS	LEV AIR 11 SA	12	
1511	22	22	26	37	37	40	32	32	59	76	75	73	63	
1611	22	21	25	35	30	40	32	32	58	75	77	73	"	MET MAY 16° MIN 12°
1711	22	21	25	35	38	40	32	32	61	79	79	77	"	
1811	21	20	25	39	38	41	32	32	66	82	82	81	64	
1911	20	20	24	35	38	41	31	31	71	85	85	84	"	
2011	20	20	24	35	38	41	32	31	72	87	87	86	"	
2111	21	20	25	35	38	40	32	32	75	87	83	86	"	
2211	20	19	25	36	37	41	32	32	74	87	82	86	"	
2311	20	19	25	36	38	41	32	31	72	83	81	86	"	
0011	20	20	25	36	38	41	32	32	77	88	82	87	"	
12-9-81 0111	20	20	25	36	43	42	32	32	79	83	84	87	"	
0211	23	20	24	35	38	42	32	32	75	86	85	84	"	
0311	23	20	24	39	39	42	32	32	81	92	85	92	"	
0411	19	19	24	35	39	42	35	31	82	90	86	93	"	
0511	20	19	24	35	39	42	32	31	83	88	90	92	"	
0611	19	19	23	35	43	42	32	31	79	91	90	89	"	
0711	20	19	24	35	43	42	31	32	83	93	87	94	"	
0811	21	20	25	35	39	42	32	32	78	93	87	90	63	MET MAY 17 at 1545
0911	20	20	25	36	40	42	33	33	82	85	85	89	64	
1011	21	21	26	35	40	43	33	33	76	86	89	85	"	
1111	21	21	26	36	40	43	33	33	76	83	83	88	63	
1211	22	21	26	36	43	43	34	32	71	87	80	85	62	
1311	23	21	27	37	40	44	34	34	67	83	83	79	63	
1411	24	22	27	38	40	44	35	33	70	82	85	79	"	
	20.75	20.42		36	39	41.71								

7-9-82	RA RET AIR 0	FRA FA/HA 1	WIA WT SCRN 2	SA LEV AIR 3	WT OFF 4	WT ON 5	MAT 6	MAT 7	RA RET AIR 8	HUMIDITY RA 9 FRA	WT SCRN WIA	LEV AIR "SA	DEW PNT 12	
1511	26	24	34	32	35	33	26	31	48	75	70	53	62	
1611	25	25	35	35	34	33.	25	26	52	75	72	57	"	FRESH AIR MAT MAX 22.7 MIN 6.7
1711	25	23	33	30	31	35	23	26	53	76	73	60	"	
1811	22	21	25	35	34	37	30	29	65	78	80	74	63	
1911	23	21	26	32	35	38	30	29	65	80	81	76	64	
2011	23	21	26	32	36	43	31	30	62	79	80	75	63.	EXPOSED WATER SURFACE AREA — APPROX. 15% OF THE TOTAL SURFACE AREA.
2111	23	22	27	33	35	40	32	31	60	77	79	73	"	
2211	27	22	26	34	37	40	32	30	52	76	78	72	"	
2311	23	21	26	33	37	41	32	35	52	77	78	73	"	
0011	27	22	27	34	38	41	33	32	40	71	72	65	64	
8-9 0111	23	21	26	34	37	41	33	31	48	73	71	66	63.	
0211	22	21	27	34	38	42	32	31	49	74	75	68	"	
0311	23	20	27	34	38	42	33	35	57	74	75	70	"	
0411	23	21	26	34	39	43.	33	33	53	76	76	71	"	
0511	22	21	27	34	39	42.	33	32.	52	77	78	73	"	
0611	22	21	26	36	43	43	32	32	52	77	78	73	"	
0711	22	21	26	35	40	41	33	32	58	77	78	73	"	
0811	25	23	28	35	40	42	33	33.	57	75	76	71	"	FRESH AIR BUREAU MAX 27.2 MIN 17.3.
0911	26	23	33	33	39	43	25	27.	54	90	78	66	68	
1011	24	24	39	35	37	38	26	28	57	77	73.	60	67.	
1111	29	26	35	35	39	23	34	32.	35	53.	62	41	61	
1211	29	31	31	34	38	35	35	35	30	53	62	39	"	
1311	30	26	30	31	33	27	35	28	31	52	63	38	"	
1411	29	27	30	29	29	24	30	26	38	56	67	44	"	
	24-79	23-75		33-46	37-13	37-79								

C.1.3 COOLING AND DEHUMIDIFICATION

C.1.3.1 ANALYSIS OF TEST DATA FOR A PERIOD OF 34 HOURS

COOLING & DEHUMIDIFICATION

REF	FRESH AIR °CDB / GM/KGDA FA	FRESH & RETURN AIR MIXTURE °CDB / GM/KGDA FRA	RETURN AIR °CDB / GM/KG DA RA	AIR LEAVING HORIZONTAL COMBINED SURFACE °CDB / GM/KG DA WA	SUPPLY AIR °CDB / GM/KG OF DA SA	MIXED AIR °CDB / GM/KG DA MA	TEMP. UPPER & LOWER LAYERS °C TSU–TSL	THERMAL ENERGY SUPPLY FROM CONVERTER WATTS QT	AIR QUANTITY THRU APPARATUS l/s AQa	TOTAL AIR QUANTITY l/s AQt	BY-PASS FACTOR APPARATUS BF1	BY-PASS FACTOR AUTOMATIC BF2	AIR CONDITIONING LOAD L WATTS	LOSS FROM APPARATUS WATTS LR	RE F
							13–15								
150209	31·5 10·0	27·5 11·6	26·5 12·0	25·0 11·5	17·0 10·2	24·5 11·2	11 – 13	7959	185	600	0·19	0·69	3108	222	
150210	31·5 9·5	27·5 11·5	26·5 12·0	24·7 11·1	15·5 9·1	23·4 10·8	9·8–11·8	7959	204	600	0·20	0·66	4406	245	
150211	31·6 9·6	27·6 11·2	26·6 11·6	24·2 10·7	15·0 8·7	22·9 10·3	8·8–10·8	7959	238	600	0·23	0·60	5383	248	
150212	30·5 9·1	26·5 11·9	25·5 12·6	23·2 11·4	14·6 8·2	20·9 10·2	8·7–10·7	7959	279	600	0·25	0·53	7199	401	
150213	30·5 10·6	26·5 12·2	25·5 12·6	23·3 11·2	14·7 8·6	20·1 10·3	8·7–10·7	7959	324	600	0·27	0·46	8088	467	
150214	31·0 10·6	27·0 12·2	26·0 12·6	23·8 11·2	15·7 8·6	19·9 9·9	9·4–11·4	7959	376	600	0·29	0·37	9160	587	
150215	31·5 10·8	27·5 11·6	26·5 11·8	24·4 10·9	16·4 8·7	19·0 9·4	10·6–12·6	7959	458	600	0·34	0·24	10085	853	
150216	31·5 10·0	27·5 11·1	26·5 11·4	24·5 10·5	16·7 9·1	18·4 9·4	11·3–13·3	7959	504	600	0·38	0·16	9555	350	
150217	30·0 12·1	26·0 12·1	25·0 12·1	23·2 11·8	16·6 9·7	21·0 10·8	10·6–12·6	7959	320	600	0·27	0·47	5914	311	
150218	29·5 11·7	25·5 12·1	24·5 12·2	22·6 11·7	15·5 9·2	20·1 10·5	10·2–12·2	7959	322	600	0·27	0·46	6670	308	
150219	26·2 13·2	23·8 12·4	23·2 12·2	21·8 11·6	14·1 9·0	20·3 11·1	8·9–10·9	7959	214	600	0·21	0·64	4672	128	
150220	26·5 12·4	24·1 11·6	23·5 11·4	21·7 11·1	13·0 8·0	20·5 10·5	8·5–10·5	5571	190	600	0·19	0·68	4582	114	
150221	26·0 11·0	23·6 11·0	23·0 11·0	21·0 10·5	13·0 8·0	20·7 10·2	8·4–10·4	3979	160	600	0·17	0·73	3415	112	
150222	24·5 13·1	22·5 11·9	22·0 11·6	20·1 11·1	12·5 7·8	20·9 11·3	8·4–10·4	2387	95	600	0·14	0·84	2337	104	
150223	〃 〃	〃 〃	〃 〃	〃 〃	〃 〃	〃 〃	8·7–10·7	1591	〃	〃	〃	〃	〃	〃	

REF	FA		FRA		RA		W/A		SA		MA		TSU-TSL	GT	Aga	AGt	BF1	BF2	L	la	RH
150224	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'4-10'4	3184	〃	〃	〃	〃	〃	〃	+
160201	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'7-10'7	1591	〃	〃	〃	〃	〃	〃	-
160202	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'4-10'4	3184	〃	〃	〃	〃	〃	〃	-
160203	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'7-10'7	1591	〃	〃	〃	〃	〃	〃	-
160204	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'4-10'4	3184	〃	〃	〃	〃	〃	〃	-
160205	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'7-10'7	1591	〃	〃	〃	〃	〃	〃	-
160206	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'4 10'4	3184	〃	〃	〃	〃	〃	〃	-
160207	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'7-10'7	1591	〃	〃	〃	〃	〃	〃	-
160208	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	8'4-10'4	3184	〃	〃	〃	〃	〃	〃	-
160209	26·5	12·8	22·1	11·2	21·0	10·8	20·5	10·5	12·4	7·8	19·4	10	8·4-10·4	3977	170	600	0·17	0·72	3712	163	-
160210	28·5	12·2	24·5	11·4	23·5	11·2	20·8	10·4	12·8	8·0	20·6	10·2	8·5-10·5	4773	198	600	0·20	0·67	4800	190	-
160211	28·8	12·4	24·8	11·6	23·8	11·4	22·0	10·9	13·2	8·1	20·7	10·4	8·5-10·5	5568	212	600	0·21	0·65	5177	204	-
160212	28·8	12·4	24·8	11·6	23·8	11·4	22·0	10·9	13·2	8·1	20·2	10·2	8·4-10·4	6364	240	600	0·23	0·60	5861	231	-
160213	32·0	12·4	26·0	11·6	24·5	11·4	23·0	10·9	14·2	8·2	20·3	10·0	8·3-10·3	7959	293	600	0·25	0·52	7114	460	-
160214	32·0	12·9	26·0	11·7	24·5	11·4	22·9	10·9	14·7	8·3	18·8	9·5	9·1-11·1	7959	382	600	0·29	0·36	9076	731	-
160215	35·5	12·9	27·5	11·7	25·5	11·4	24·3	10·9	16·3	8·7	18·7	9·3	10·4-12·4	7959	475	600	0·36	0·21	10659	602	-
160216	34·5	11·9	26·5	11·5	24·5	11·4	23·8	11·0	17·0	9·3	18·5	9·9	11·2-13·2	7959	512	600	0·38	0·15	9216	614	-
160217	30·0	12·2	26·0	11·4	25·0	11·2	23·7	11·0	17·8	9·8	18·8	10·2	11·3-13·3	7959	528	600	0·39	0·12	7730	507	-
160218	28·0	12·9	24·8	11·7	24·0	11·4	22·7	11·1	15·8	9·3	20·6	10·7	10·2-12·2	7959	292	600	0·25	0·52	4905	280	-

(C.1.3.1) PSYCHROMETRIC CHARTS FOR THIS PERIOD OF 34 HOURS

AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING & HEATING, INC.

BAROMETRIC PRESSURE 101.325 kPa

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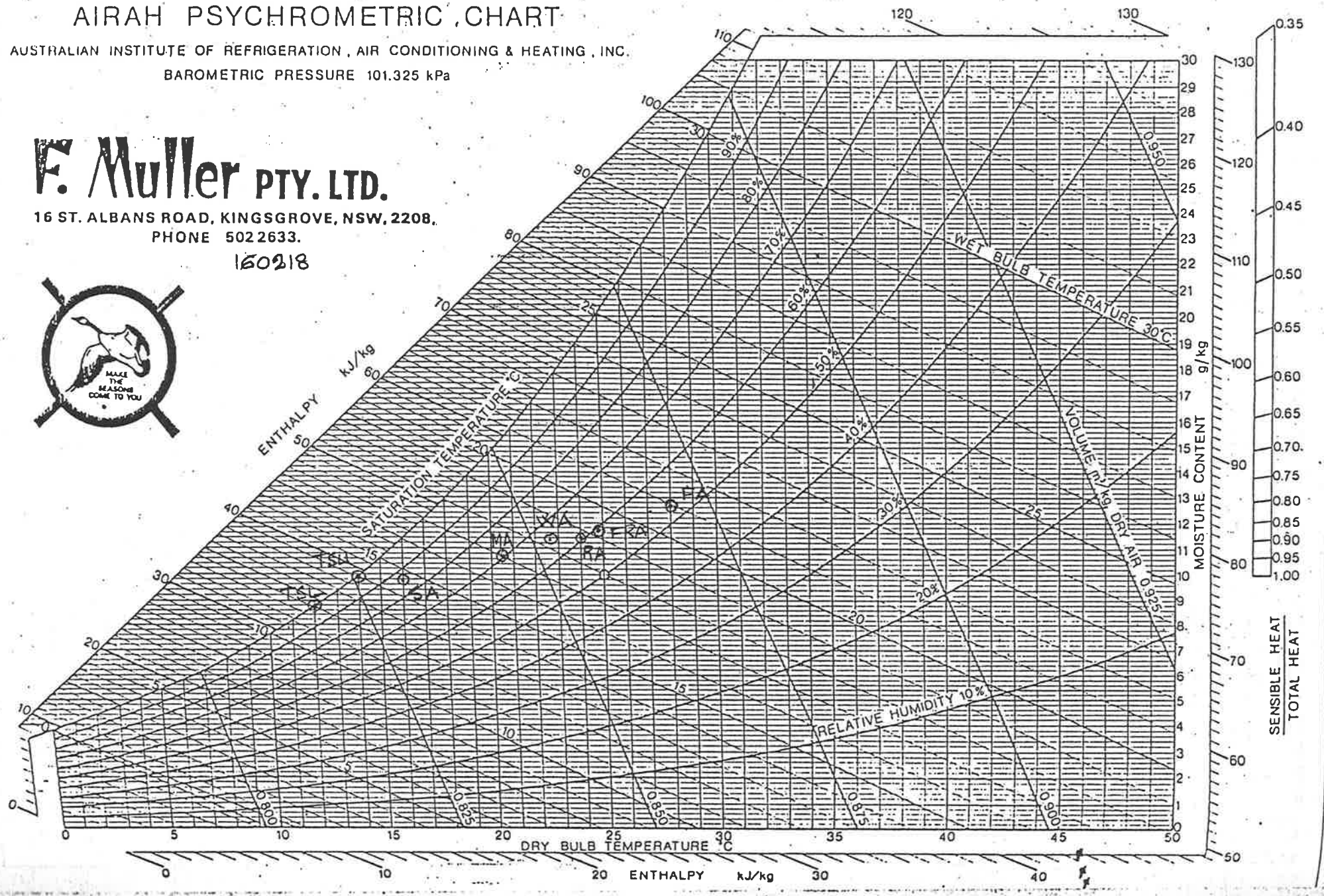
PHONE 502 2633.

160218



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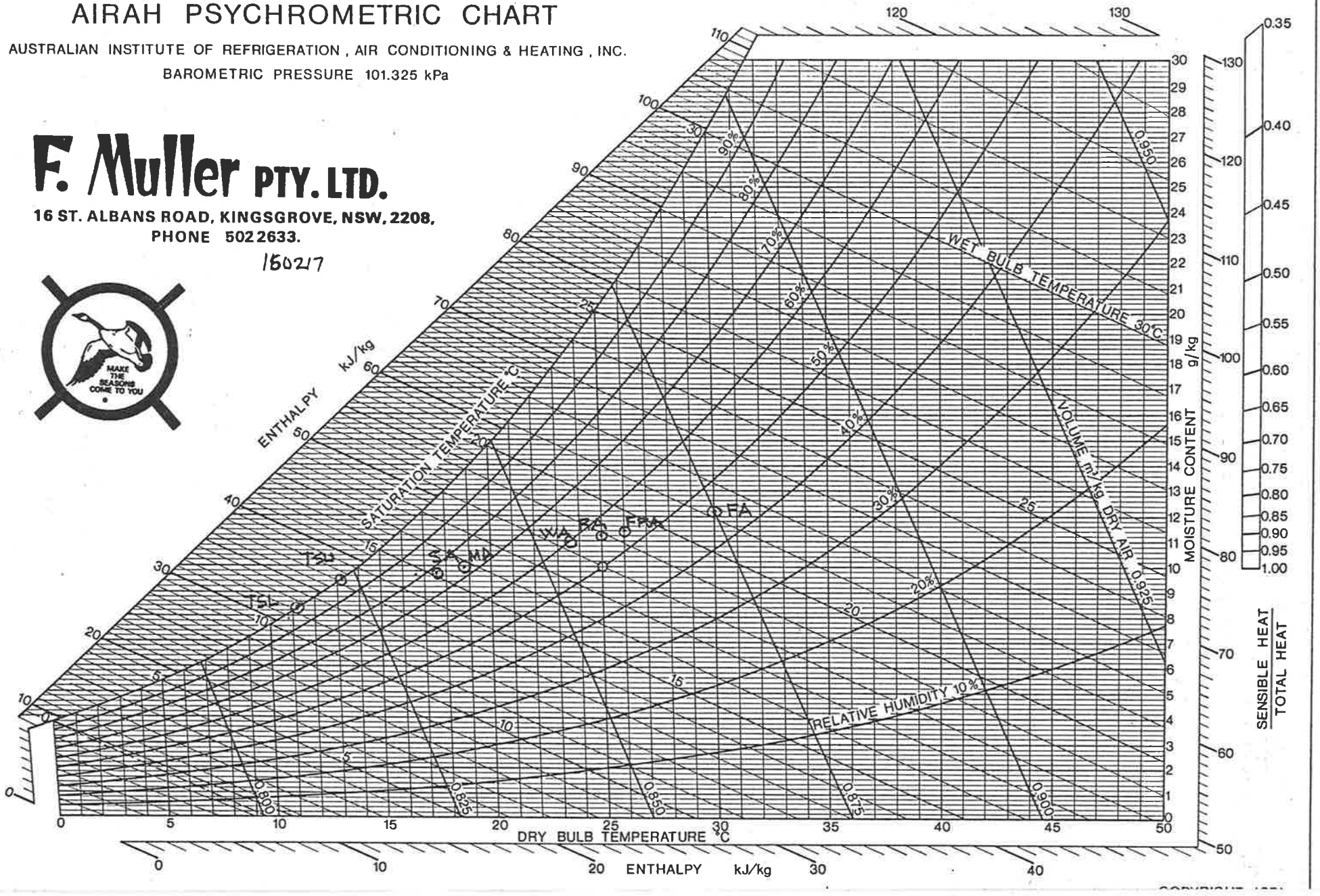
150217



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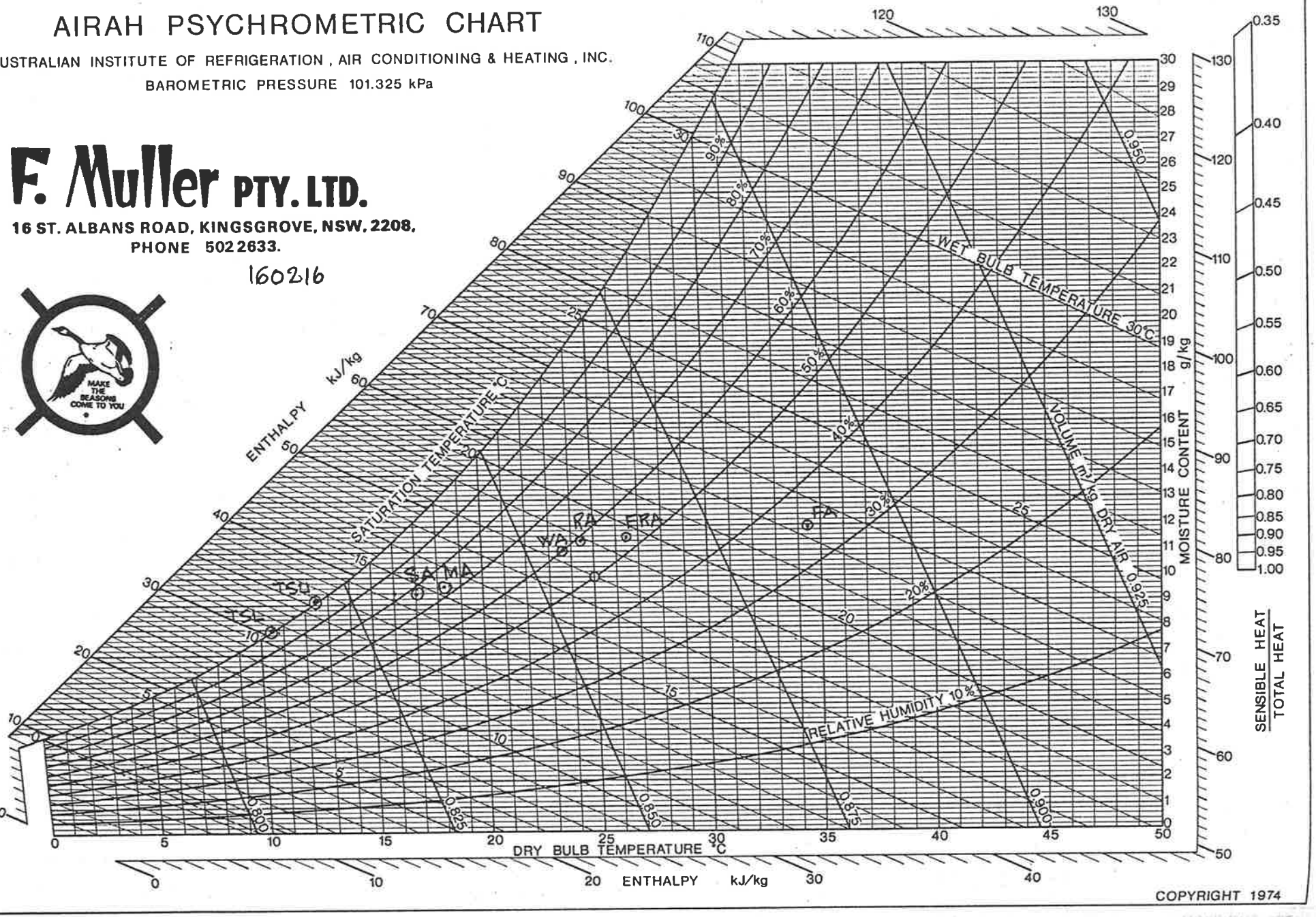
160216



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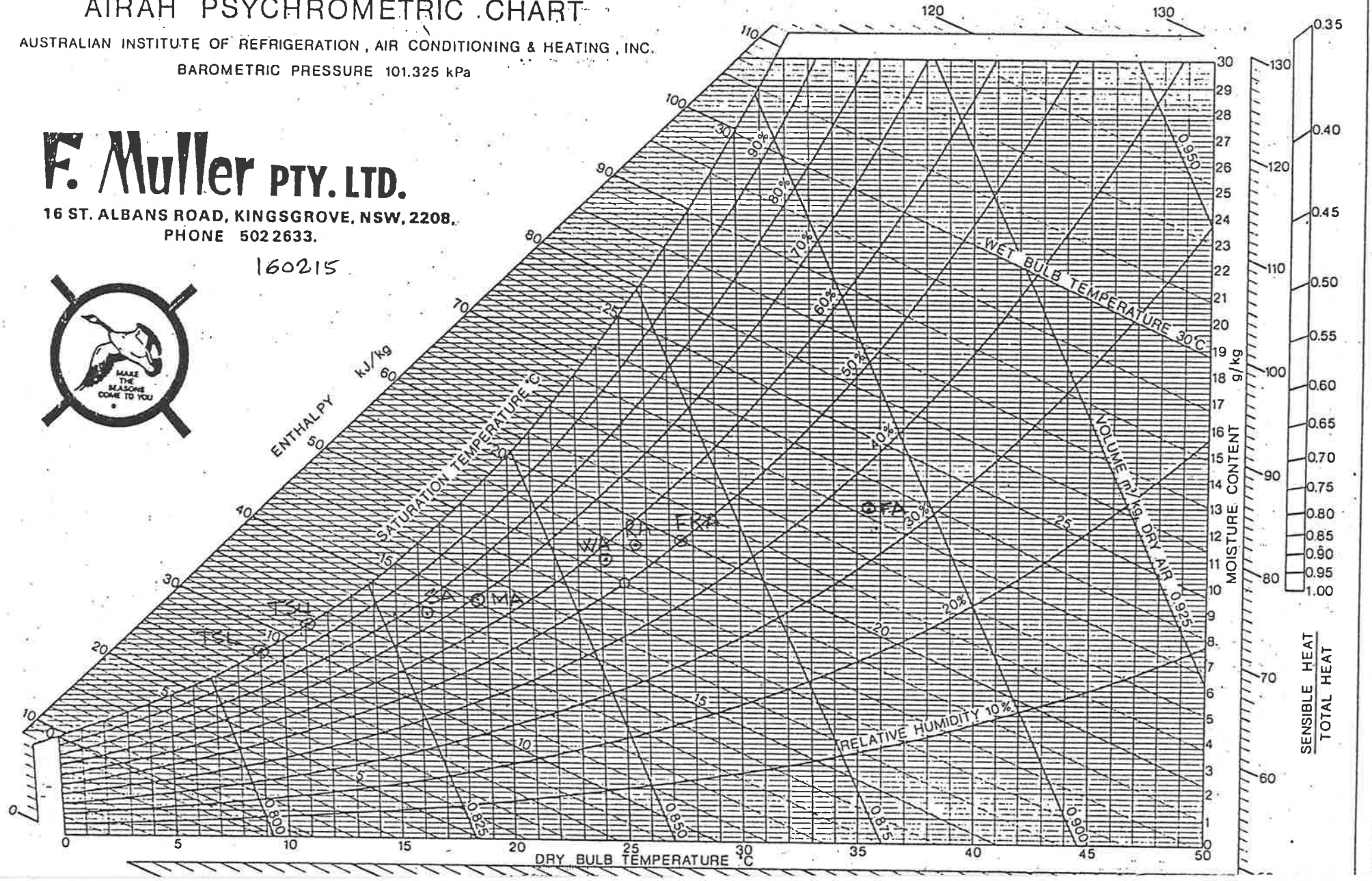
160215



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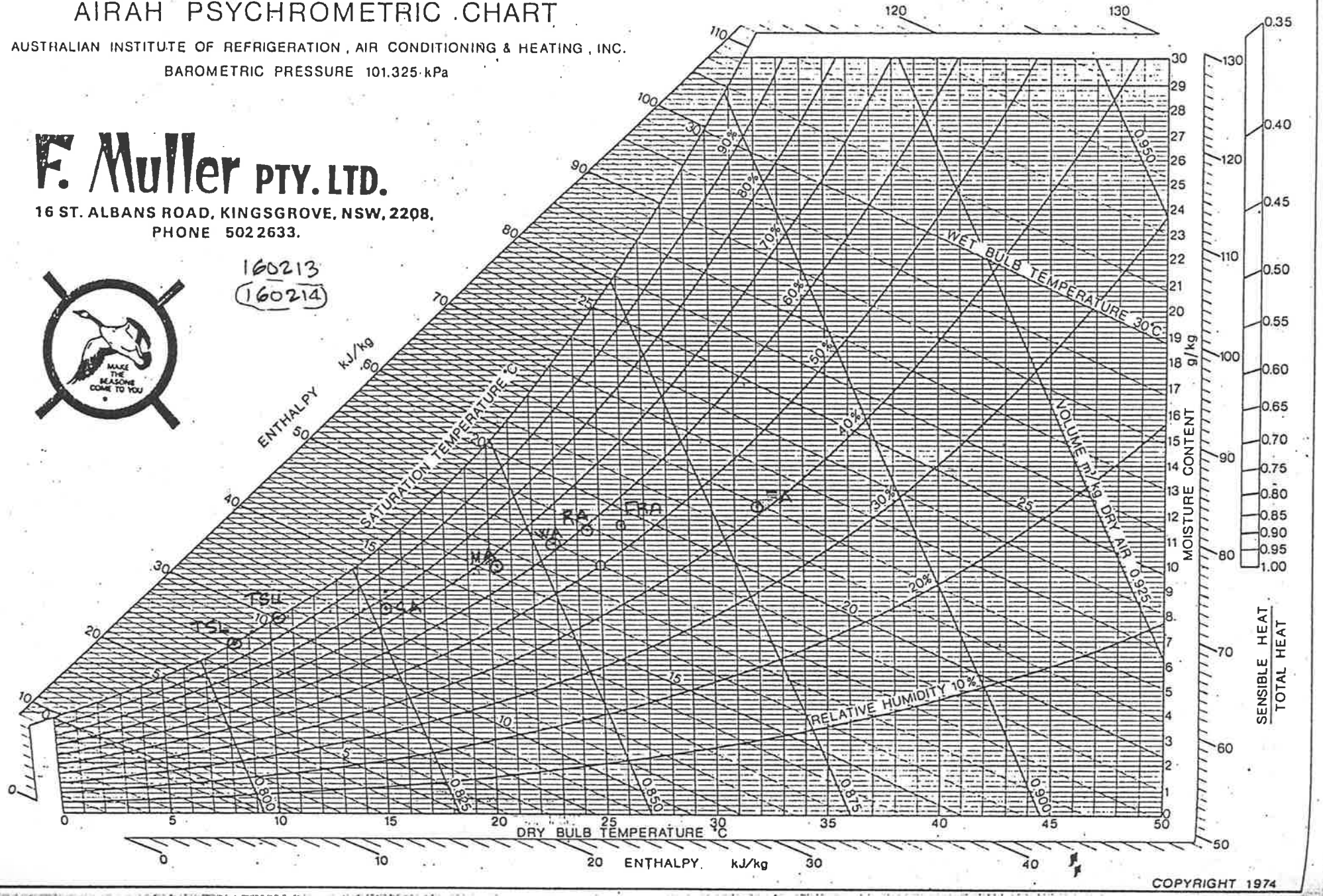
160213

160214



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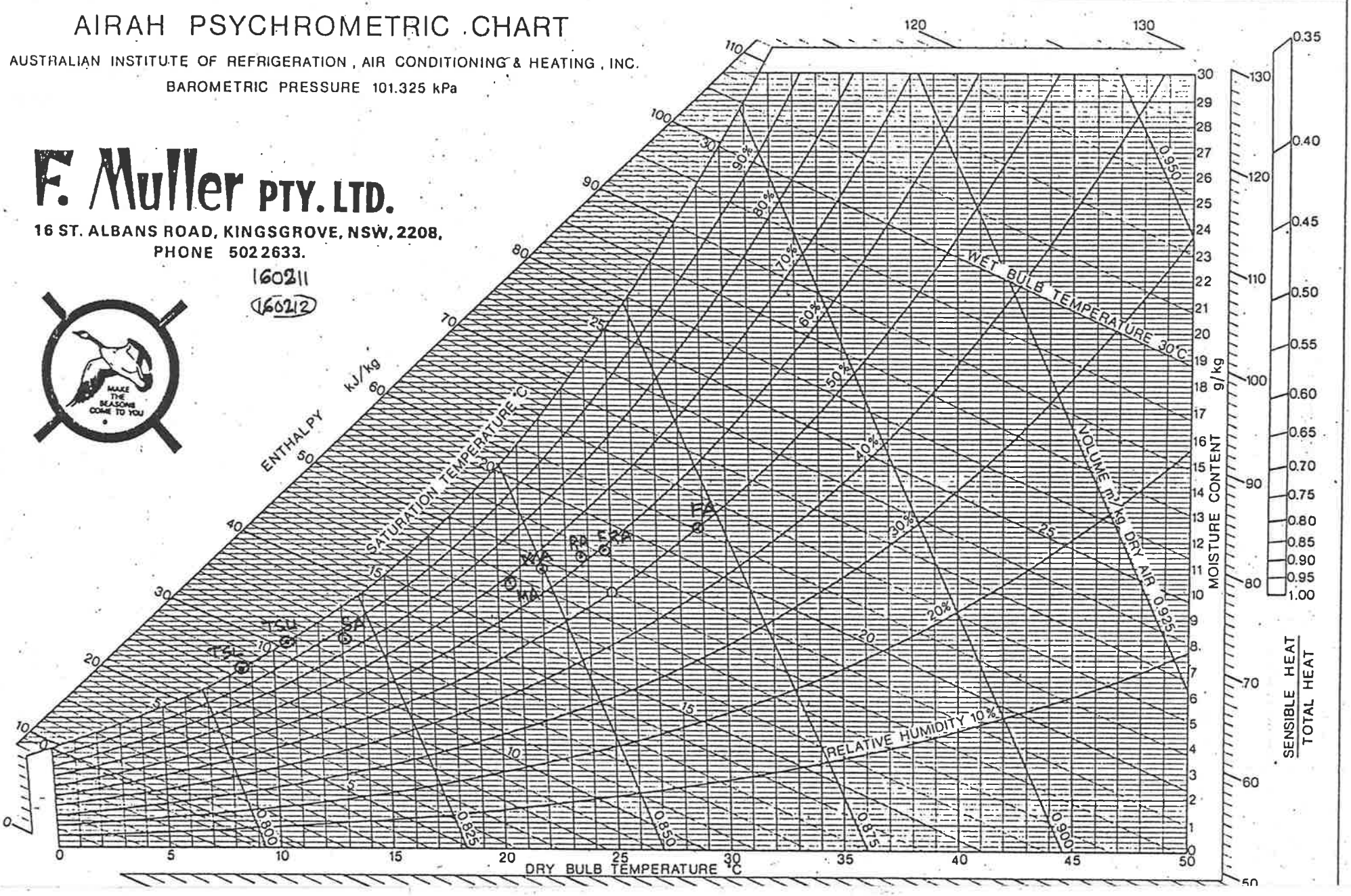
160211

160212



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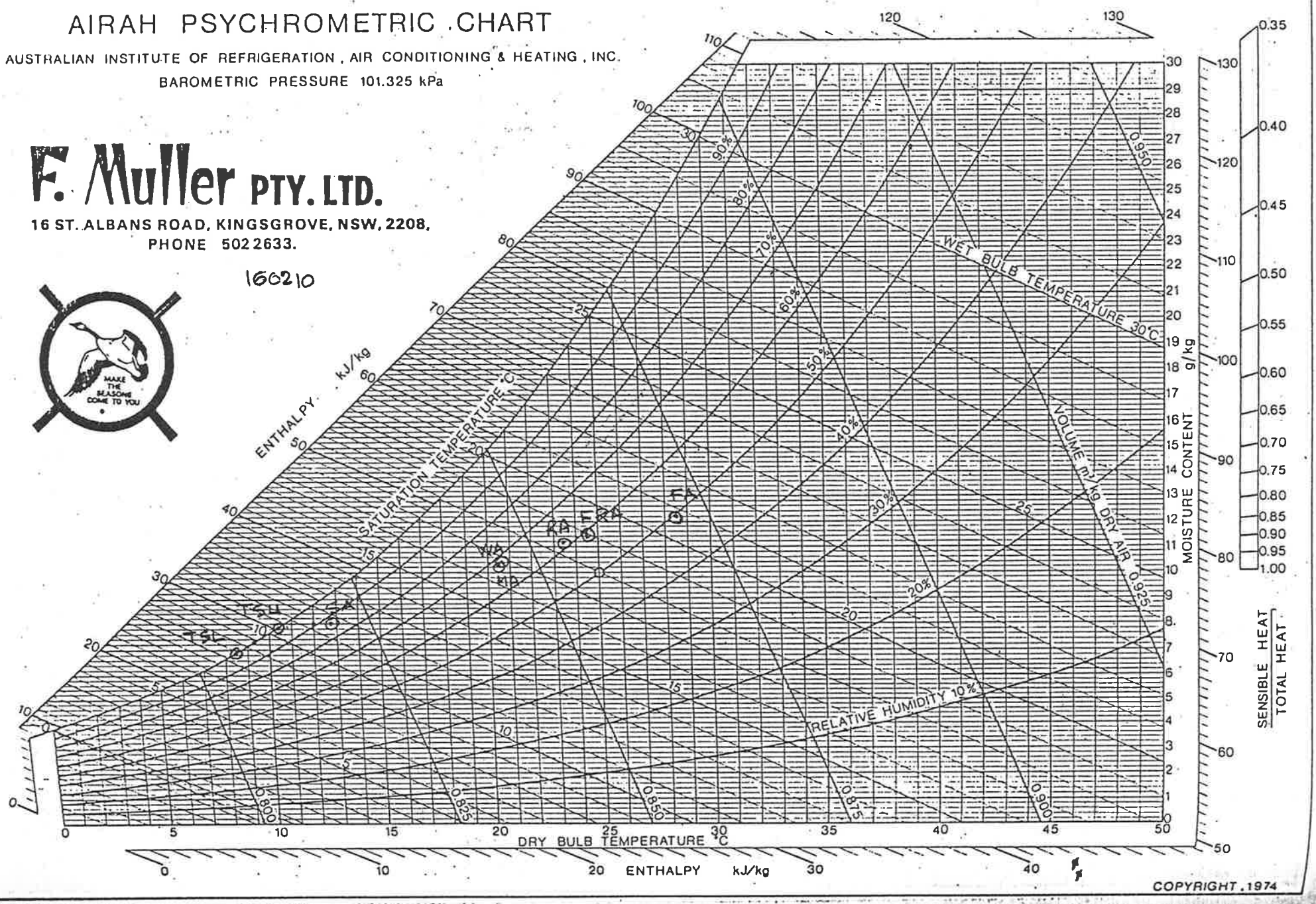
160210



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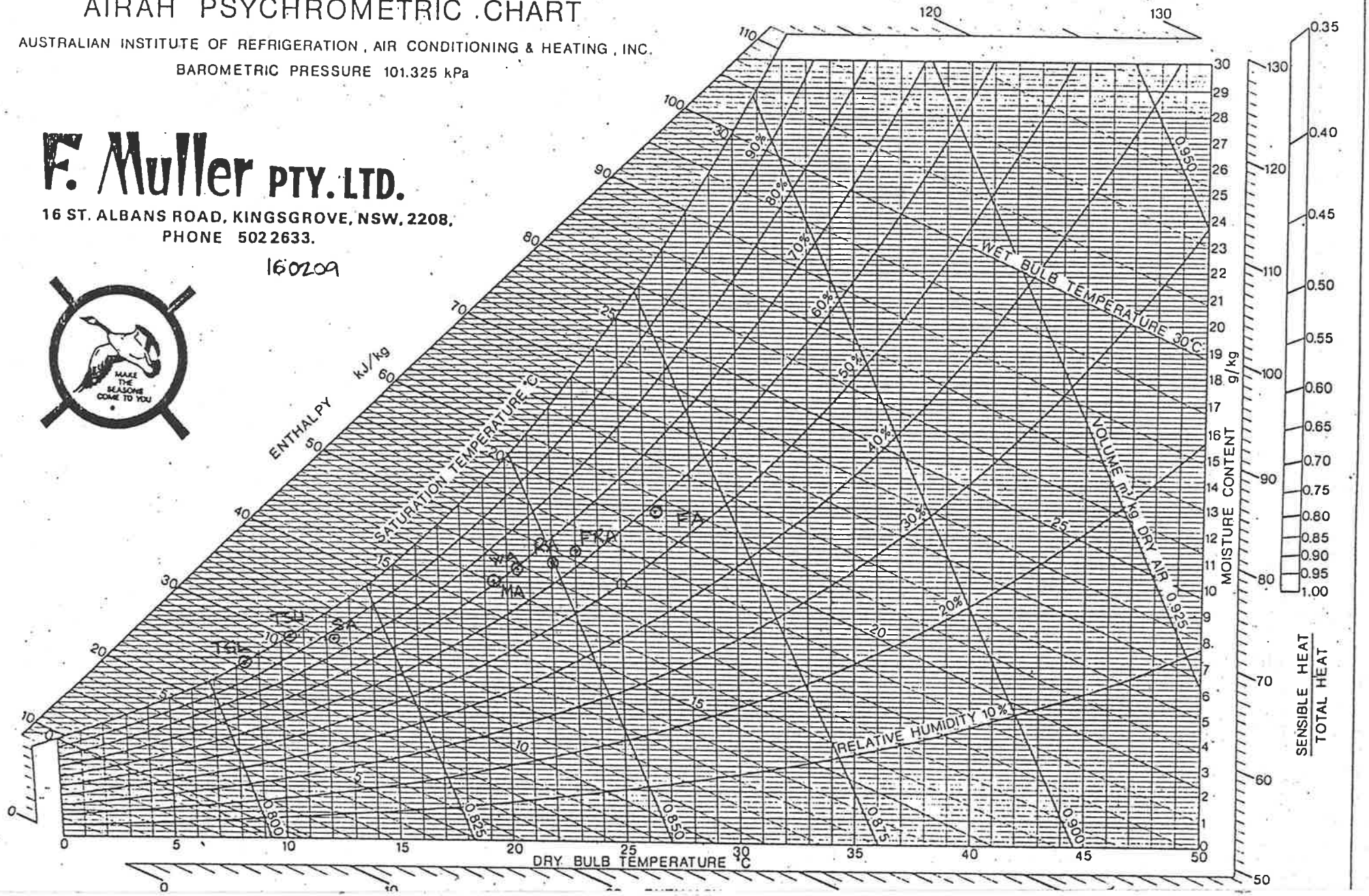
160209



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150222
150223
150224
160201
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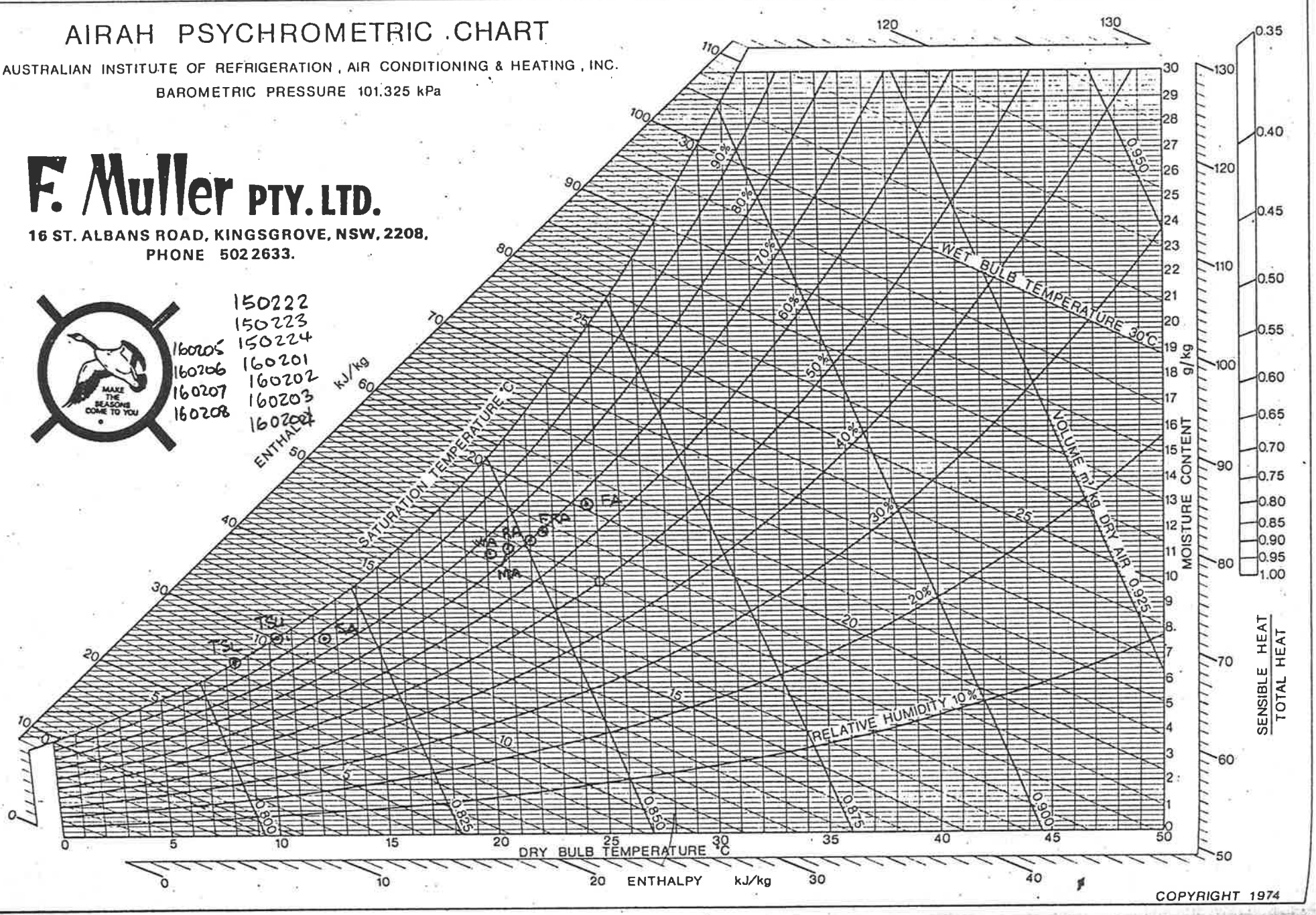

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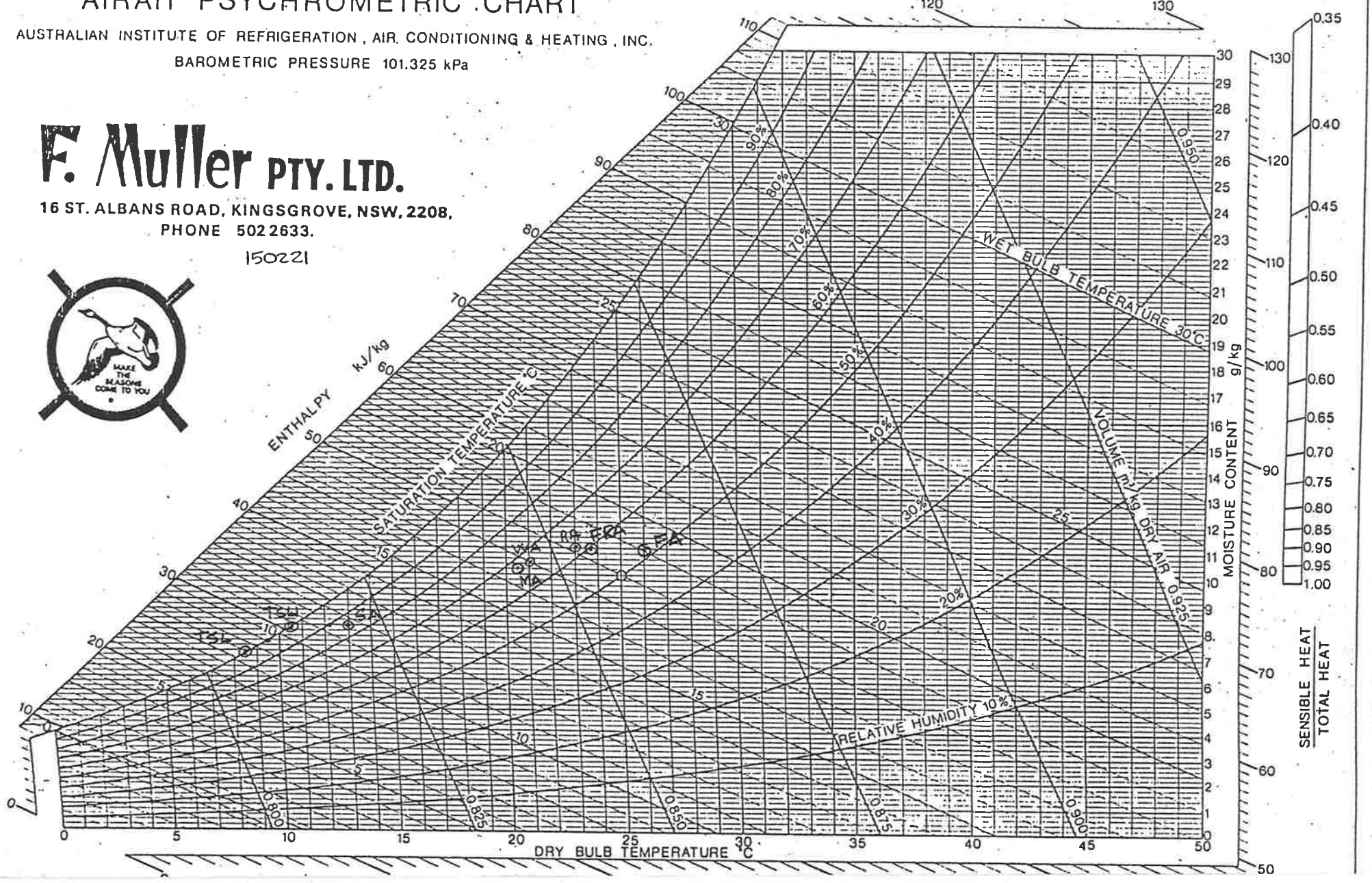
150221



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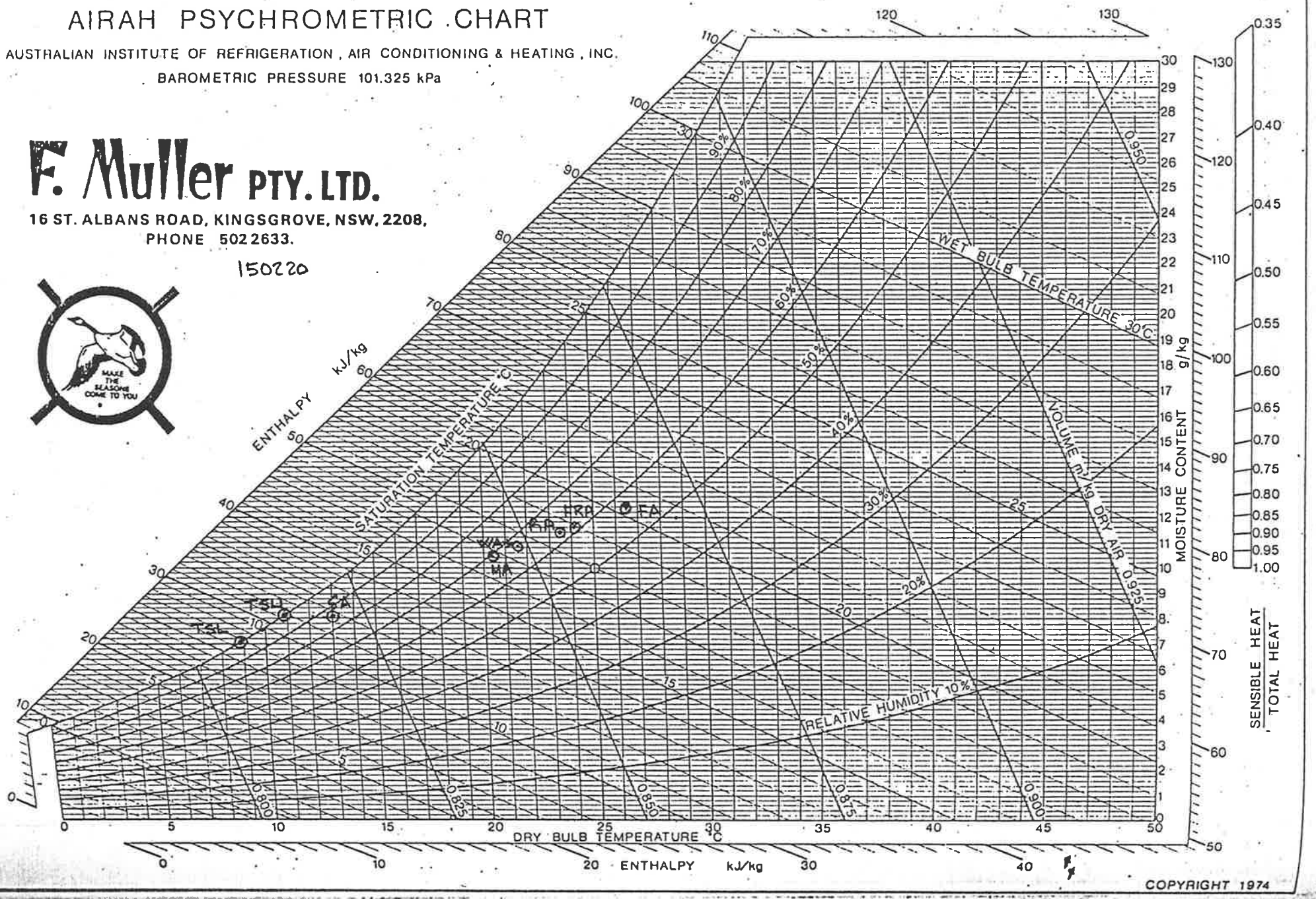
BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

16 ST. ALBANS ROAD, KINGSGROVE, NSW, 2208,

PHONE 502 2633.

150220



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BAROMETRIC PRESSURE 101.325 kPa

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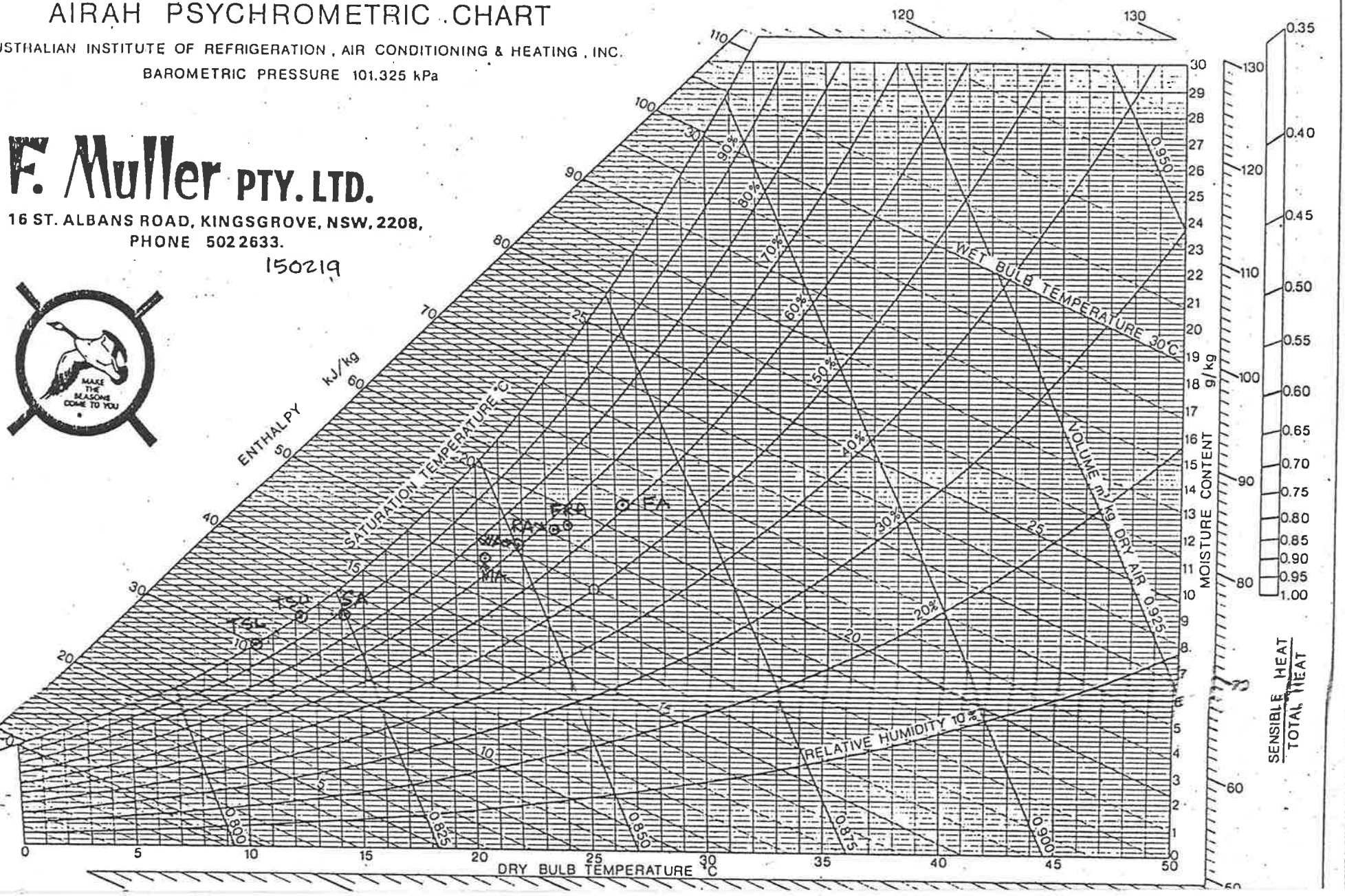
PHONE 502 2633.

150219



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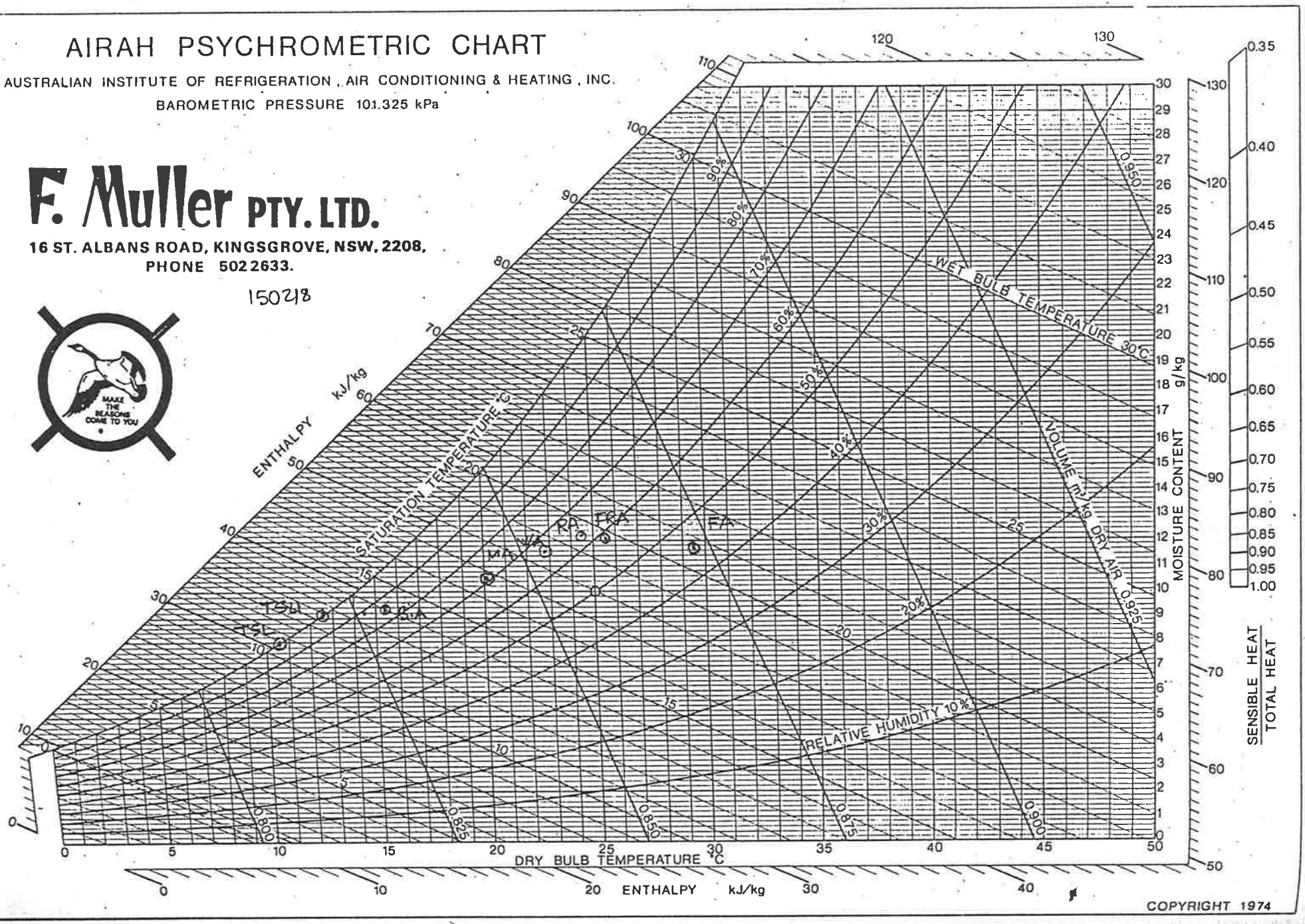
150218



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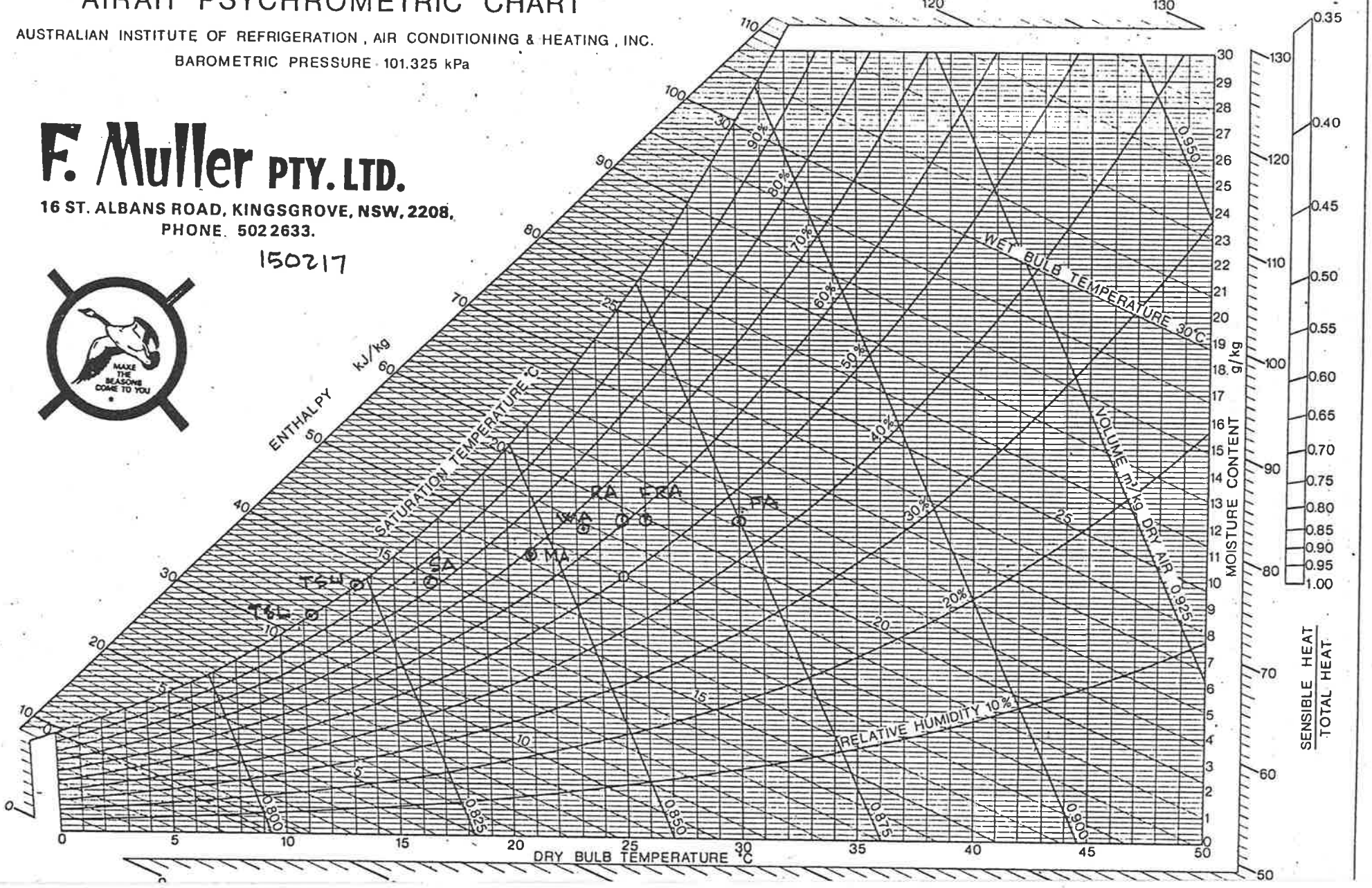
150217



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BAROMETRIC PRESSURE 101.325 kPa

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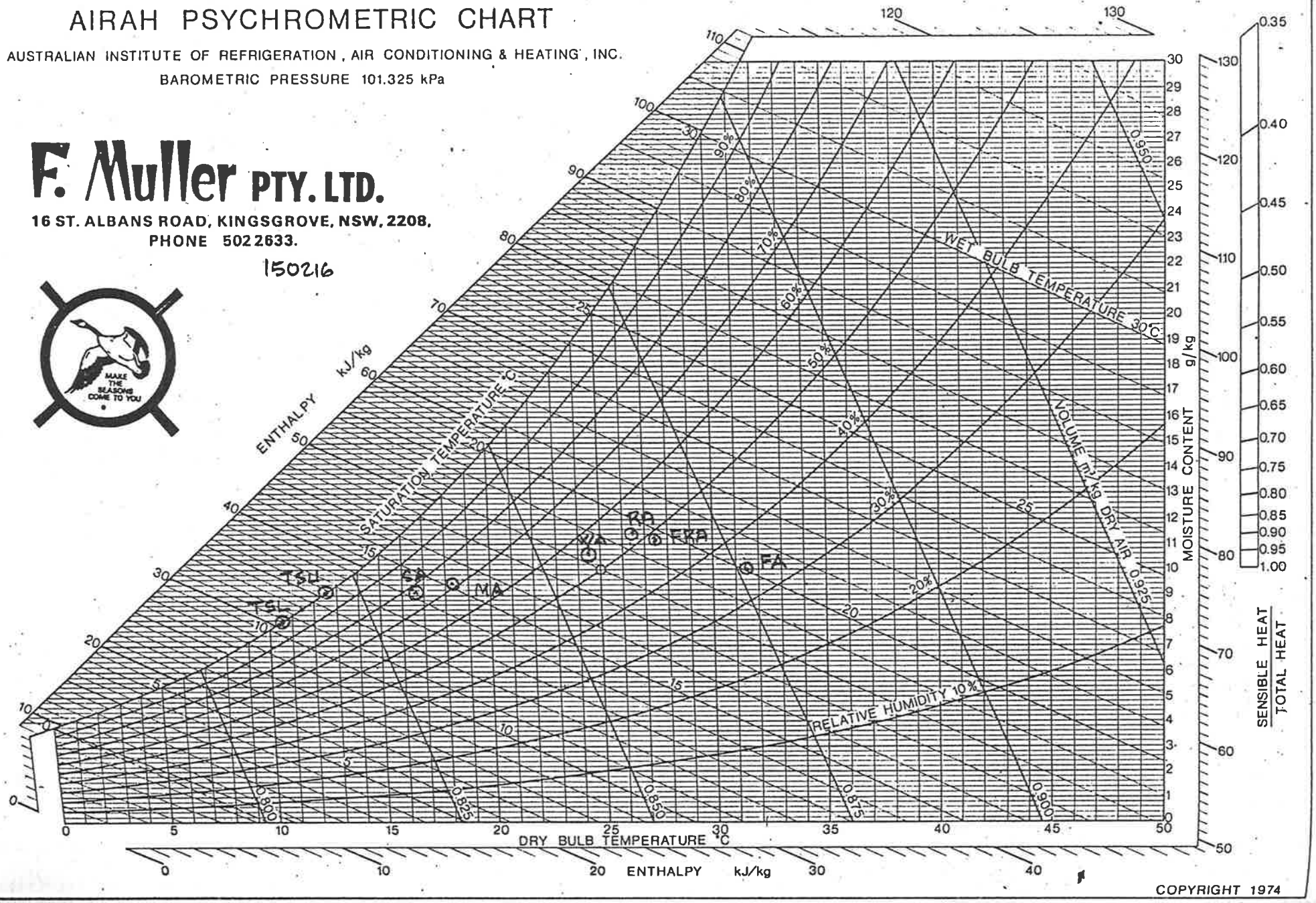
PHONE 502 2633.

150216



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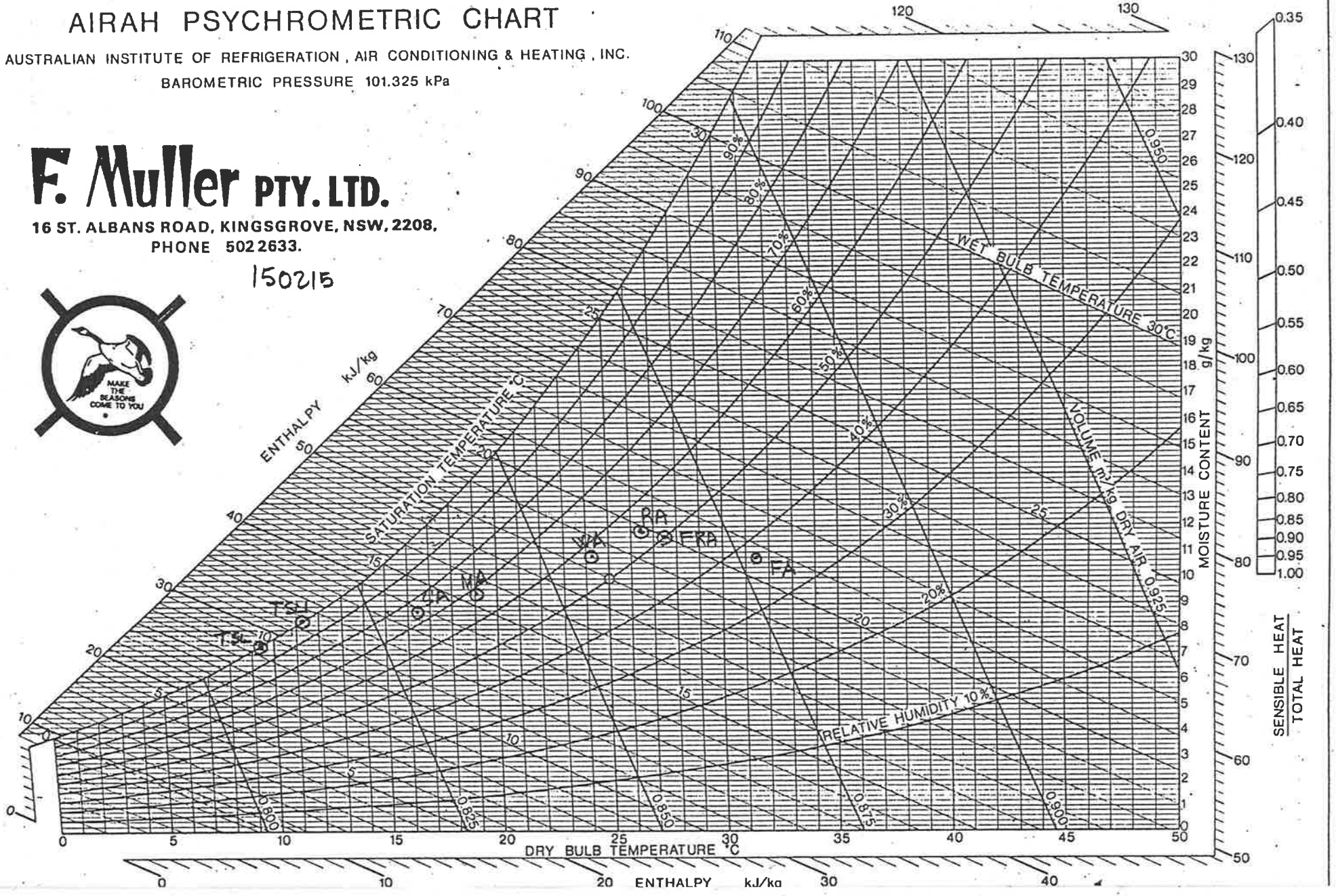
150215



AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING & HEATING, INC.

BAROMETRIC PRESSURE 101.325 kPa

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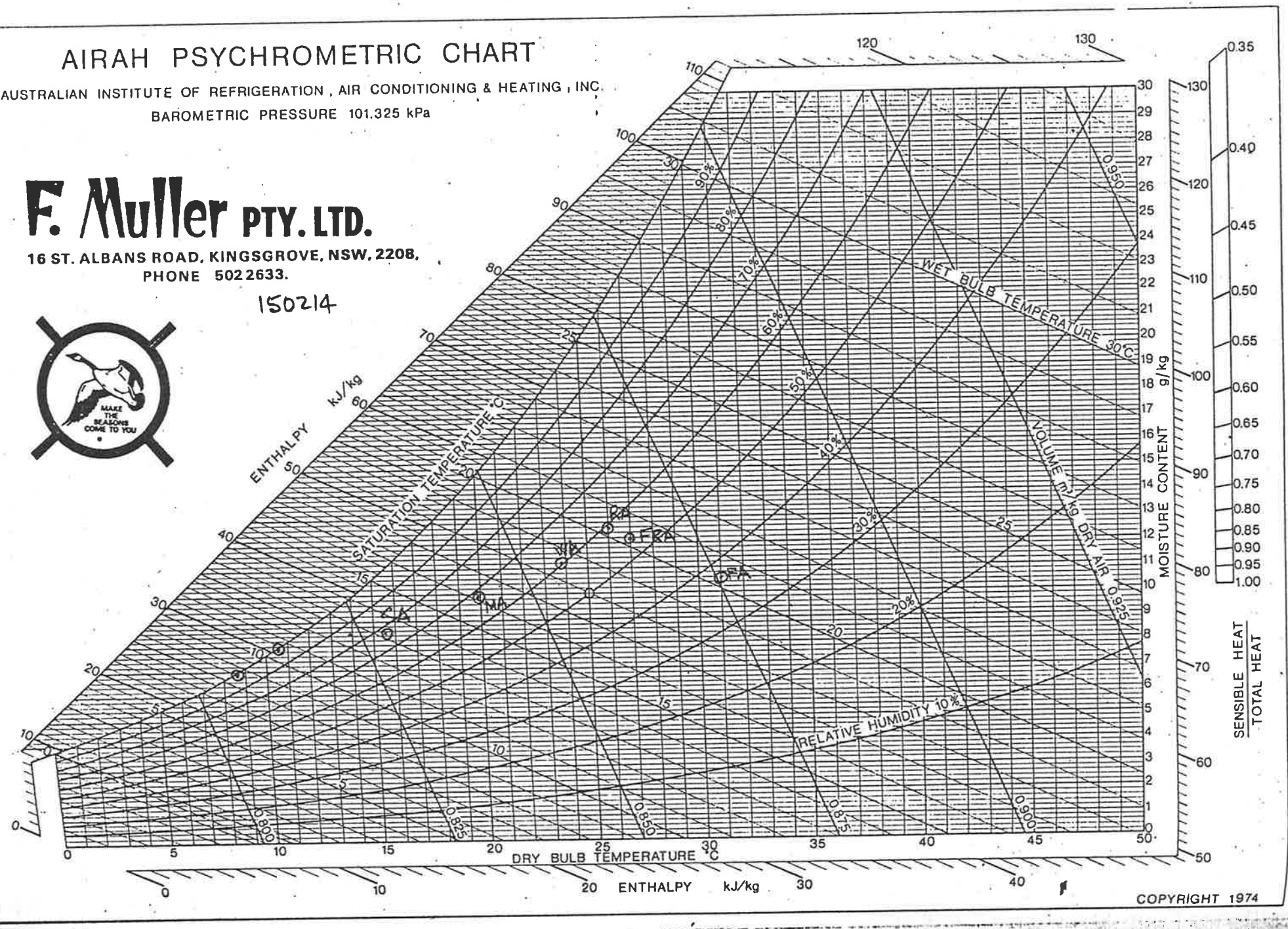
PHONE 502 2633.

150214



AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING & HEATING, INC.

BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

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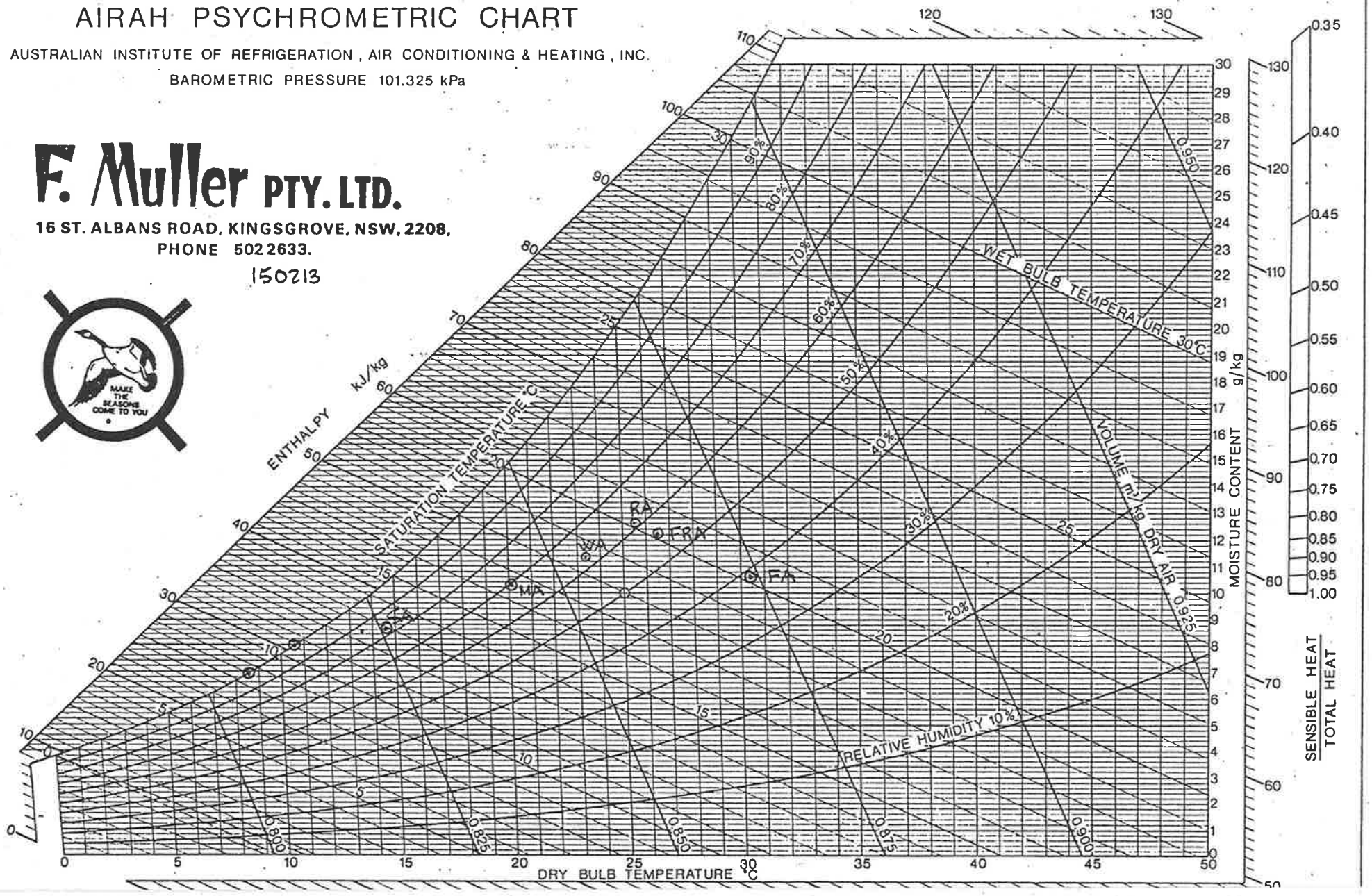
PHONE 502 2633.

150213



AIRAH PSYCHROMETRIC CHART

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BAROMETRIC PRESSURE 101.325 kPa

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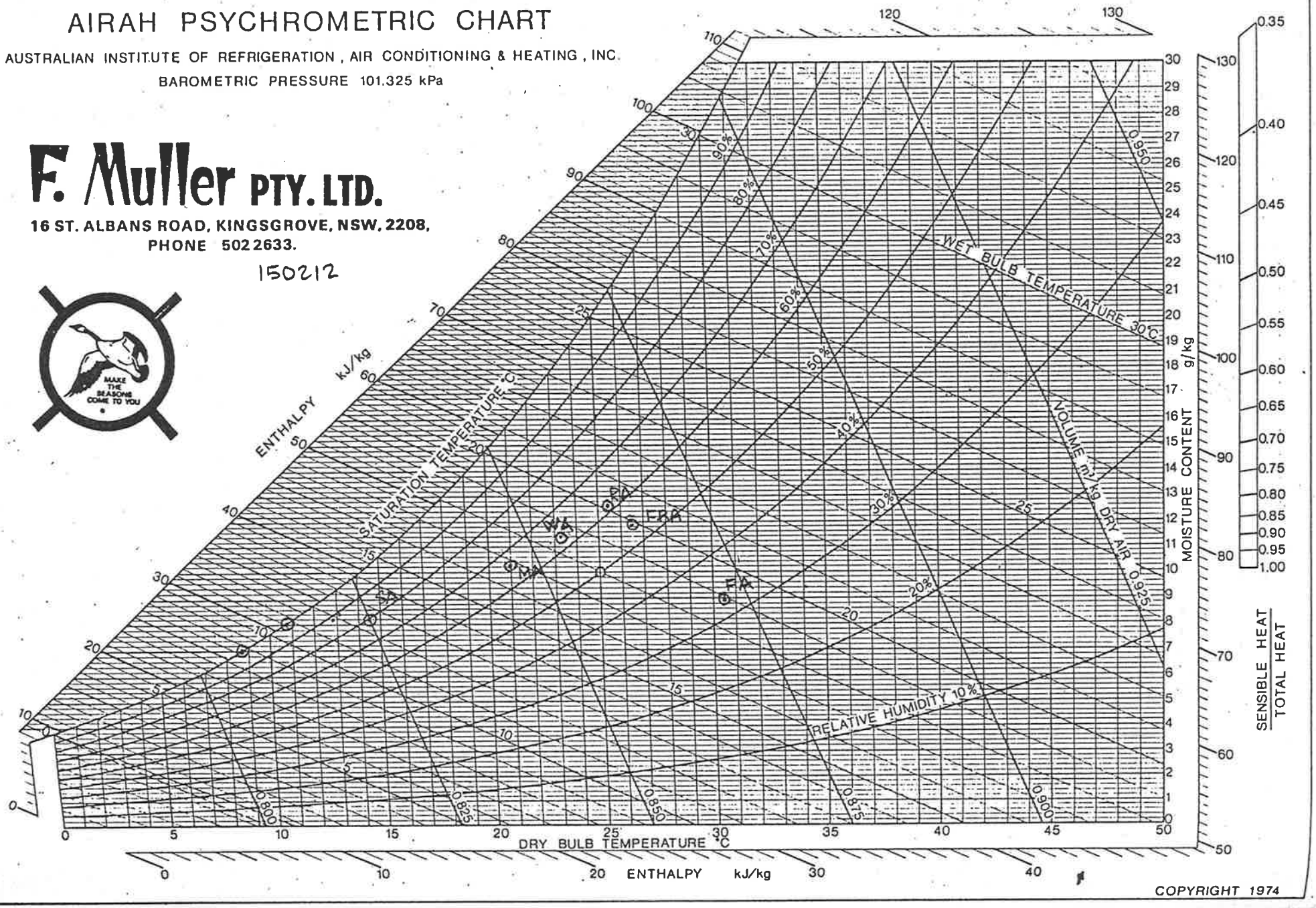
PHONE 502 2633.

150212



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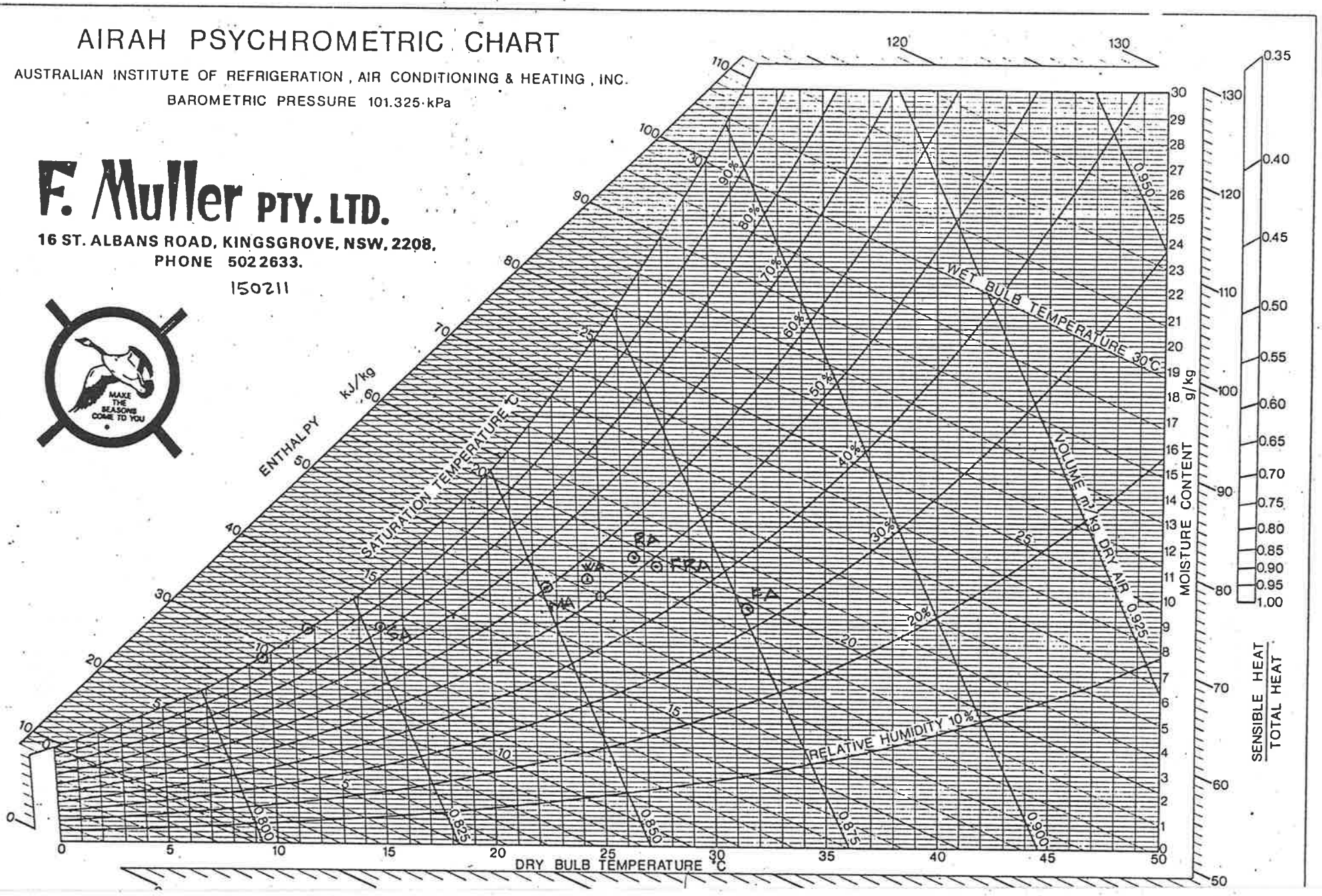
PHONE 502 2633.

150211



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BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

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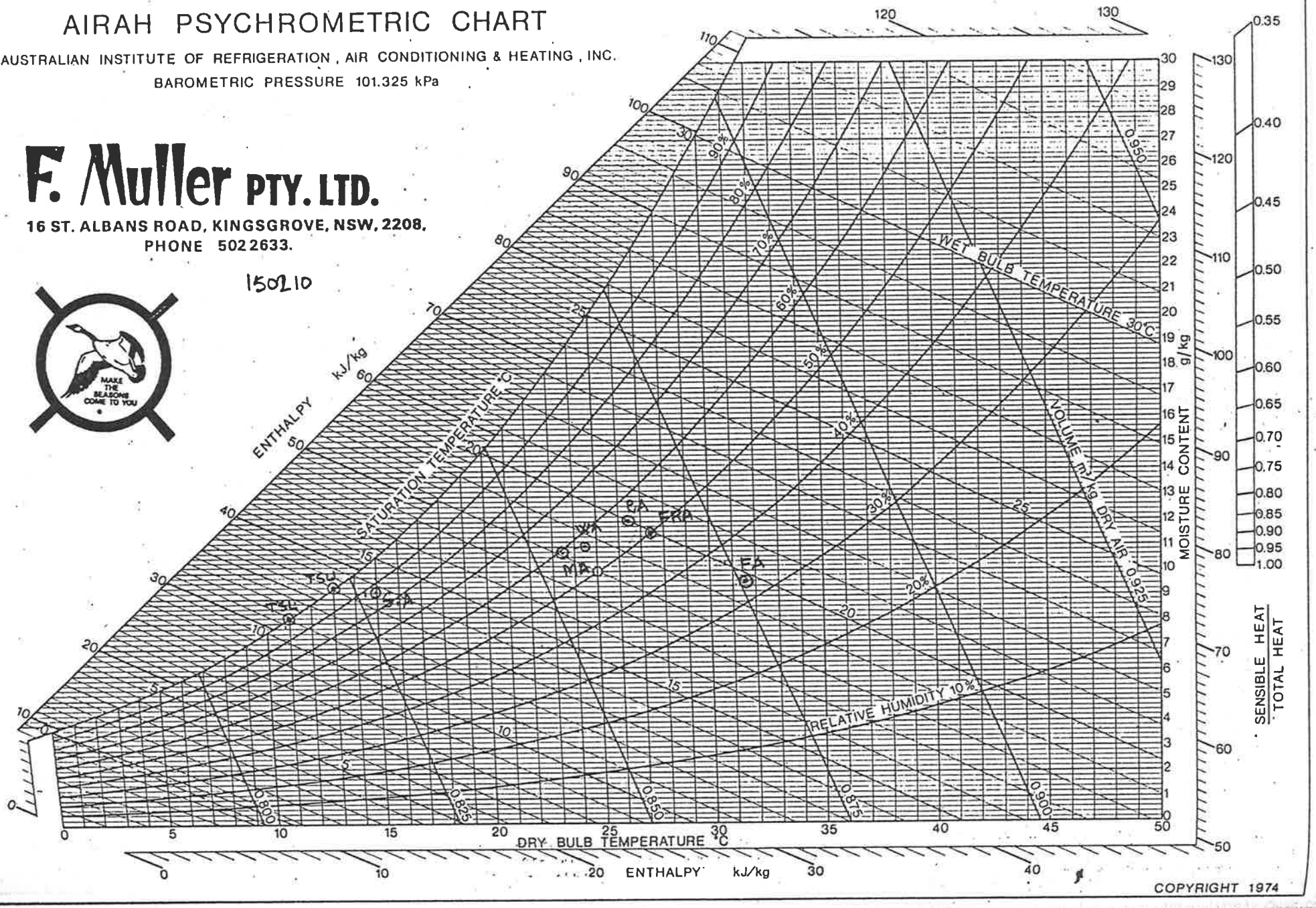
PHONE 502 2633.

150210



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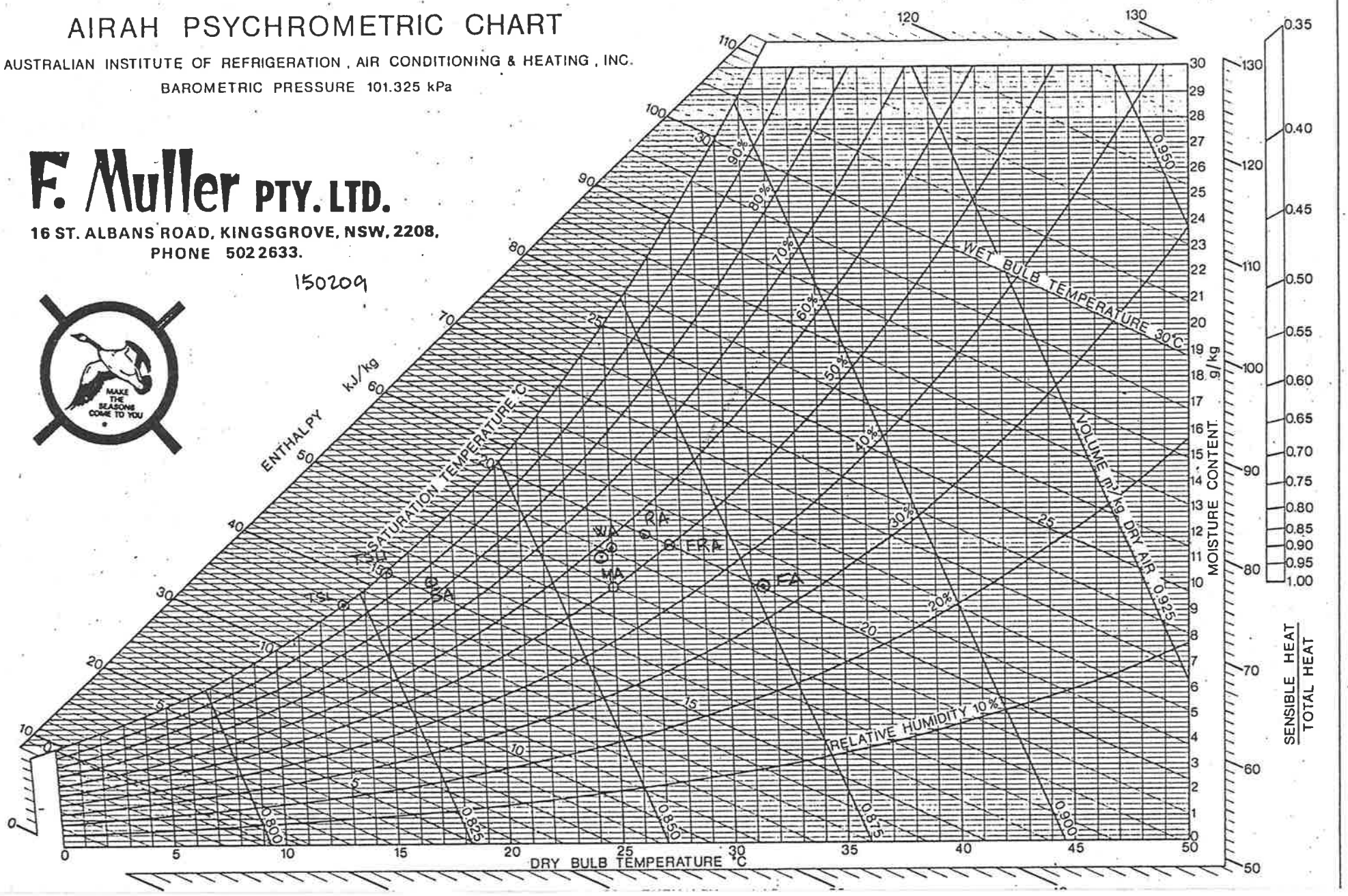
PHONE 502 2633.

150209



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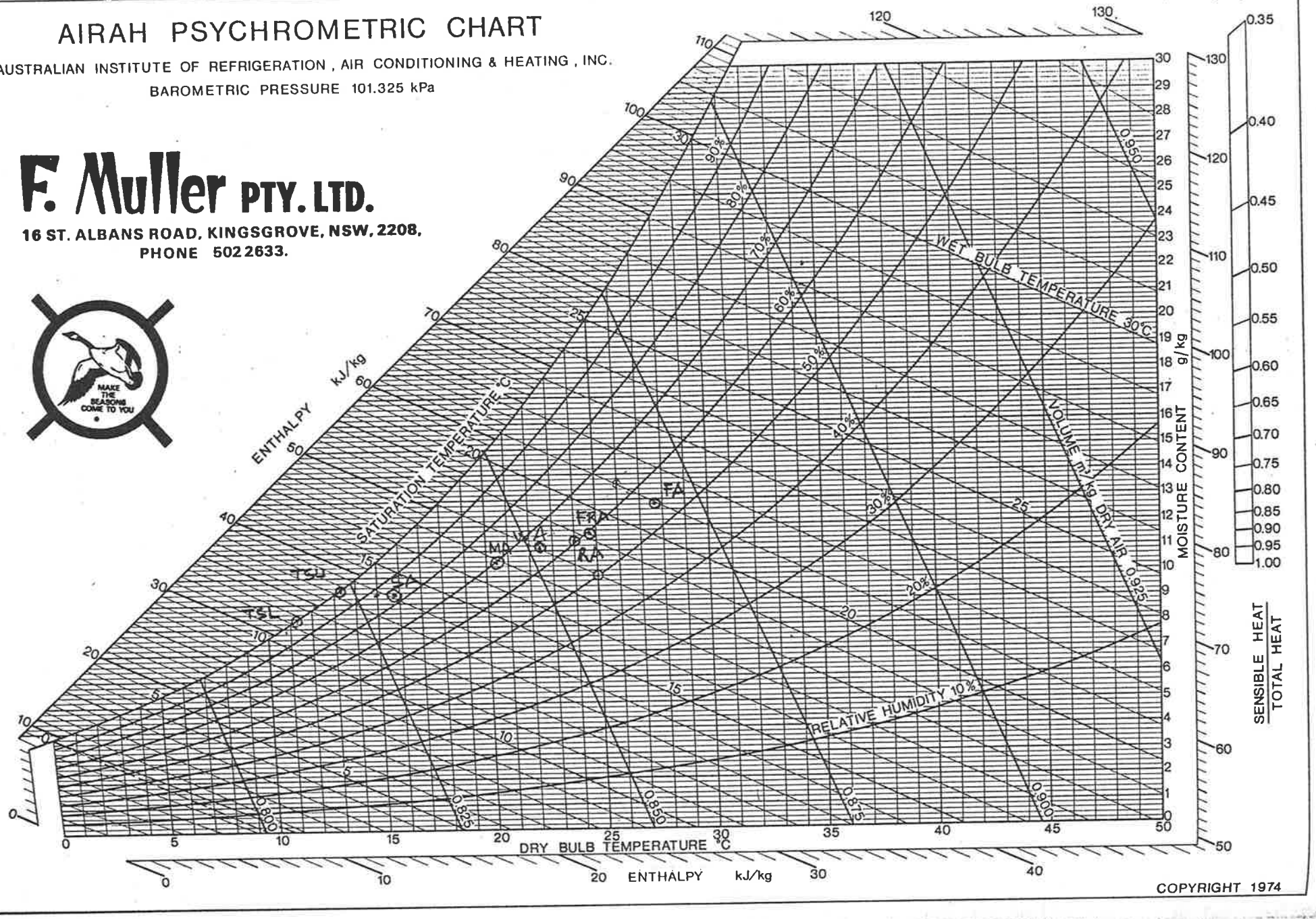
AUSTRALIAN INSTITUTE OF REFRIGERATION , AIR CONDITIONING & HEATING , INC.

BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

16 ST. ALBANS ROAD, KINGSGROVE, NSW, 2208,
PHONE 502 2633.



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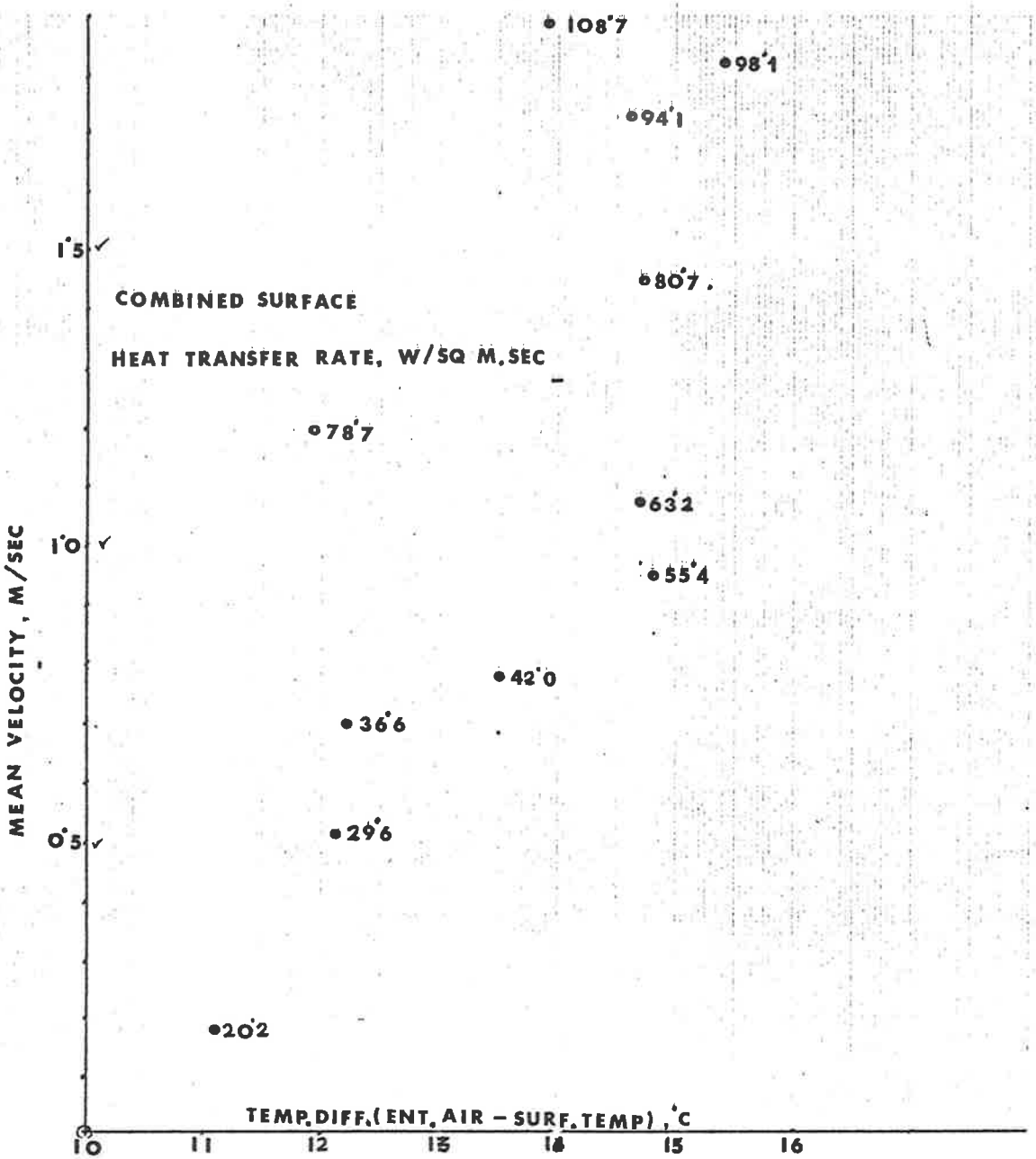
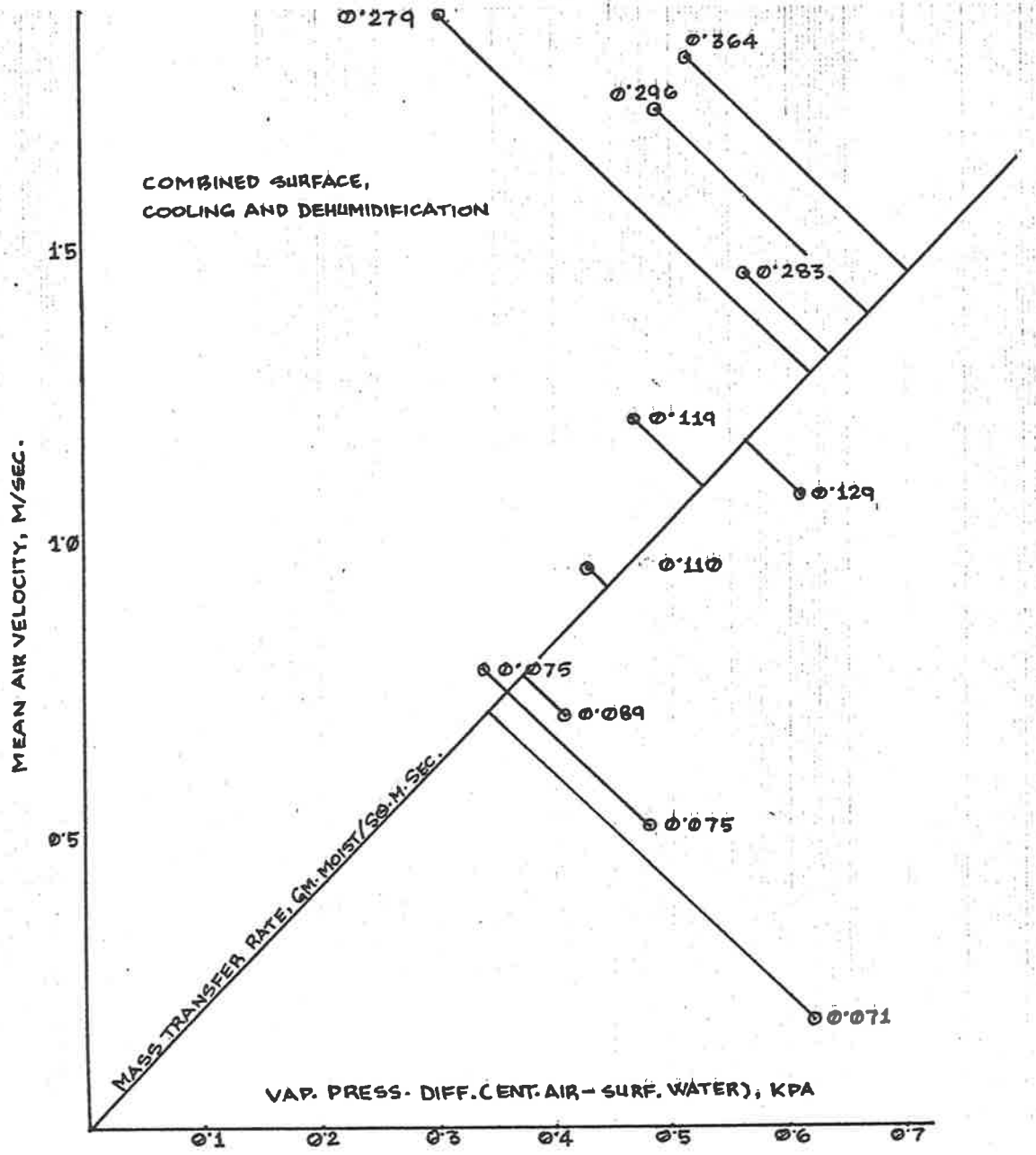
C.1.3.3 HEAT AND MASS TRANSFER COMBINED SURFACE

COMBINED SURFACE

AIR QUANTITY L/S	AIR ON °CDB	AIR ON MC GM/KG D.A	AIR OFF °CDB	AIR OFF MC GM/KG D.A	WATER SURFACE TEMP. °C	COMBINED SURFACE AREA M^2	AIR VELOCITY M/SEC	AIR MASS FLOW KG.D.A/SEC	LOG MEAN TEMP. DIFF °C	TOTAL SENS ENERGY TRANSFER WATTS	LENGTH OF WATER SURFACE M	HEAT TRANSFER W/M^2 °C	VAPOUR PRESS. DIFF KPA	MASS TRANSFER GM/SQ.M.SEC	TEMP DIFF. (ENT. AIR – WATER SURF.
504	27·5	11·1	24·5	10·5	12·6	1·25	1·89	0·5817	13·35	1814	2·1	108·7	0·304	0·279	14·9
458	27·5	11·6	24·4	10·9	11·4	1·25	1·73	0·5282	14·49	1704	2·1	94·1	0·488	0·296	16·1
475	27·5	11·7	24·3	10·9	11·1	1·25	1·82	0·5682	14·74	1824	2·1	98·1	0·515	0·364	16·4
382	26·0	11·7	22·9	10·9	10·3	1·25	1·45	0·4428	14·09	1421	2·1	80·7	0·562	0·283	15·7
322	25·5	12·1	22·6	11·7	12·6	1·25	1·20	0·3735	11·39	1121	2·1	78·7	0·467	0·119	12·9
279	26·5	11·9	23·2	11·4	10·8	1·25	1·07	0·3226	13·98	1105	2·1	63·2	0·609	0·129	15·7
238	27·6	11·2	24·2	10·7	11·8	1·25	0·95	0·2744	14·03	972	2·1	55·4	0·426	0·110	15·8
204	27·5	11·5	24·7	11·1	13·0	1·25	0·78	0·2352	13·04	685	2·1	42·0	0·339	0·075	14·5
190	24·1	11·6	21·7	11·1	10·9	1·25	0·70	0·2219	11·96	547	2·1	36·6	0·407	0·089	13·2
160	23·6	11·0	21·0	10·5	10·5	1·25	0·51	0·1871	13·46	499	2·1	29·6	0·478	0·075	13·1
95	22·5	11·9	20·1	11·1	10·4	1·25	0·18	0·1114	10·85	274	2·1	20·2	0·619	0·071	12·1


108·7
98·1
94·1
80·7
78·7
63·2
55·4
42·0
36·6
29·6
20·2
COMBINED SURFACE
HEAT TRANSFER RATE, W/SQ M.SEC
MEAN VELOCITY, M/SEC
1·5
1·0
0·5
TEMP.DIFF.(ENT.AIR – SURF.TEMP), °C
10
11
12
13
14
15
16

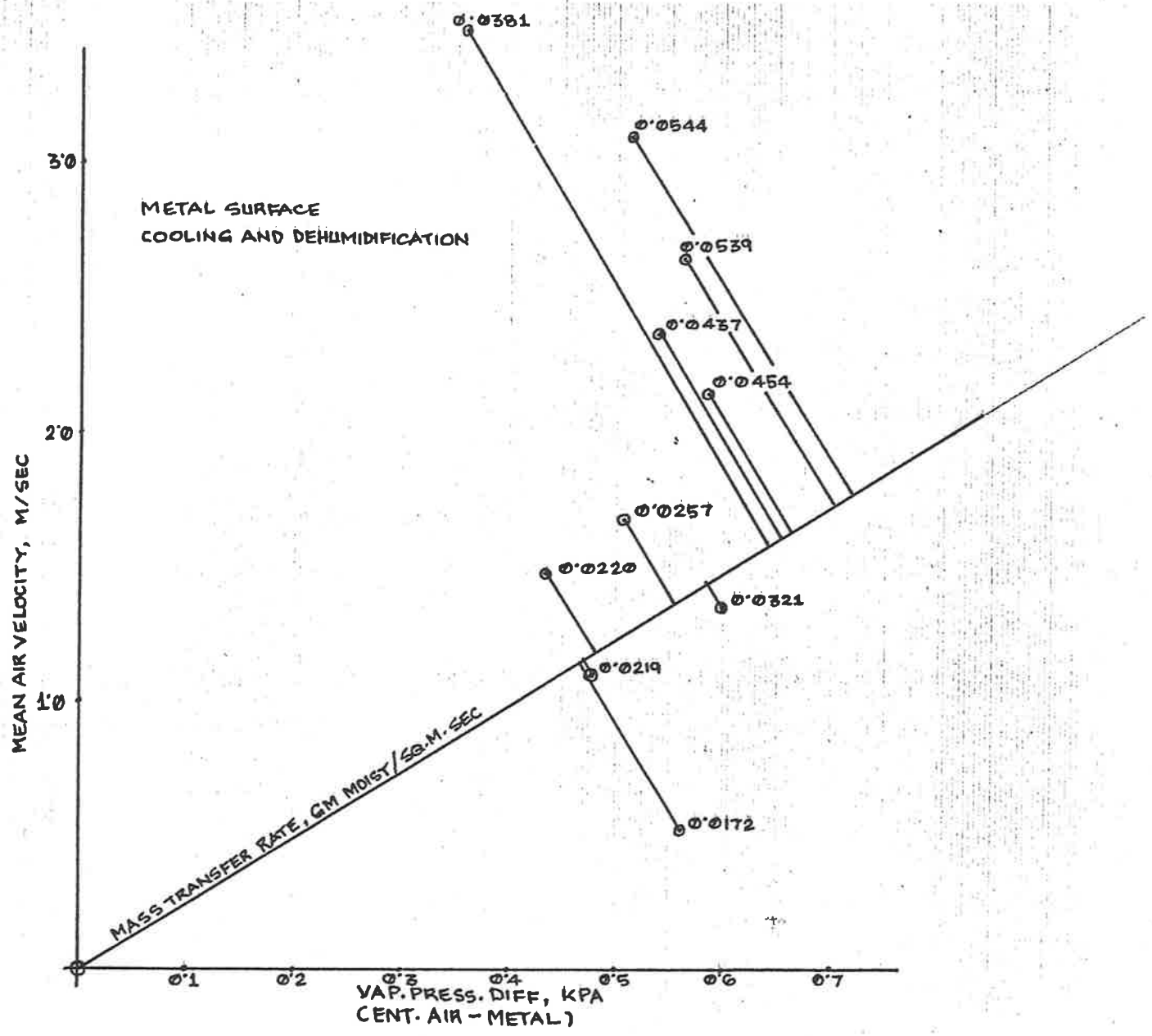

COMBINED SURFACE,
COOLING AND DEHUMIDIFICATION
MEAN AIR VELOCITY, M/SEC.
1·5
1·0
0·5
MASS TRANSFER RATE, GM. MOIST/SQ.M.SEC.
0·279
0·364
0·296
0·283
0·119
0·129
0·110
0·075
0·089
0·075
0·071
VAP. PRESS. DIFF. (ENT. AIR – SURF. WATER), KPA
0·1
0·2
0·3
0·4
0·5
0·6
0·7

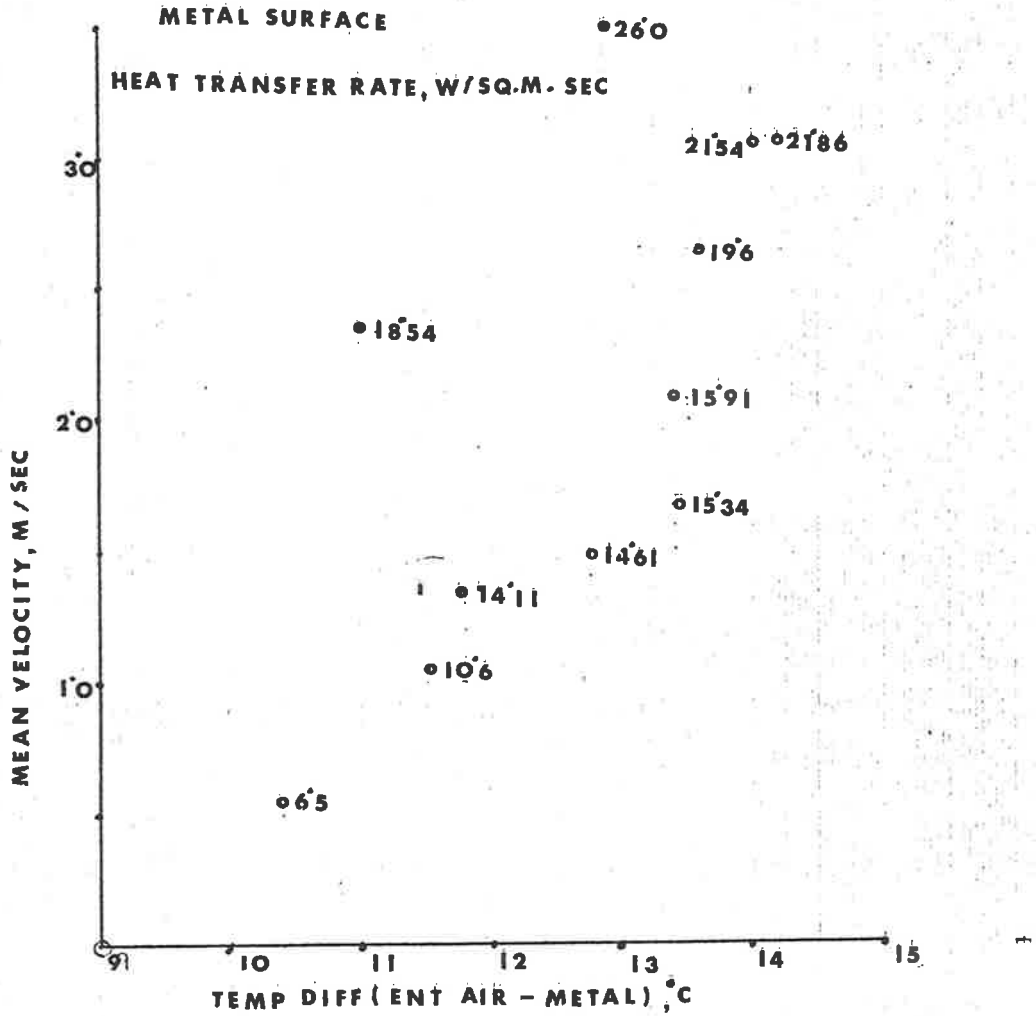
B

(C.1.3.4) HEAT AND MASS TRANSFER FOR METAL SURFACE

METAL SURFACE

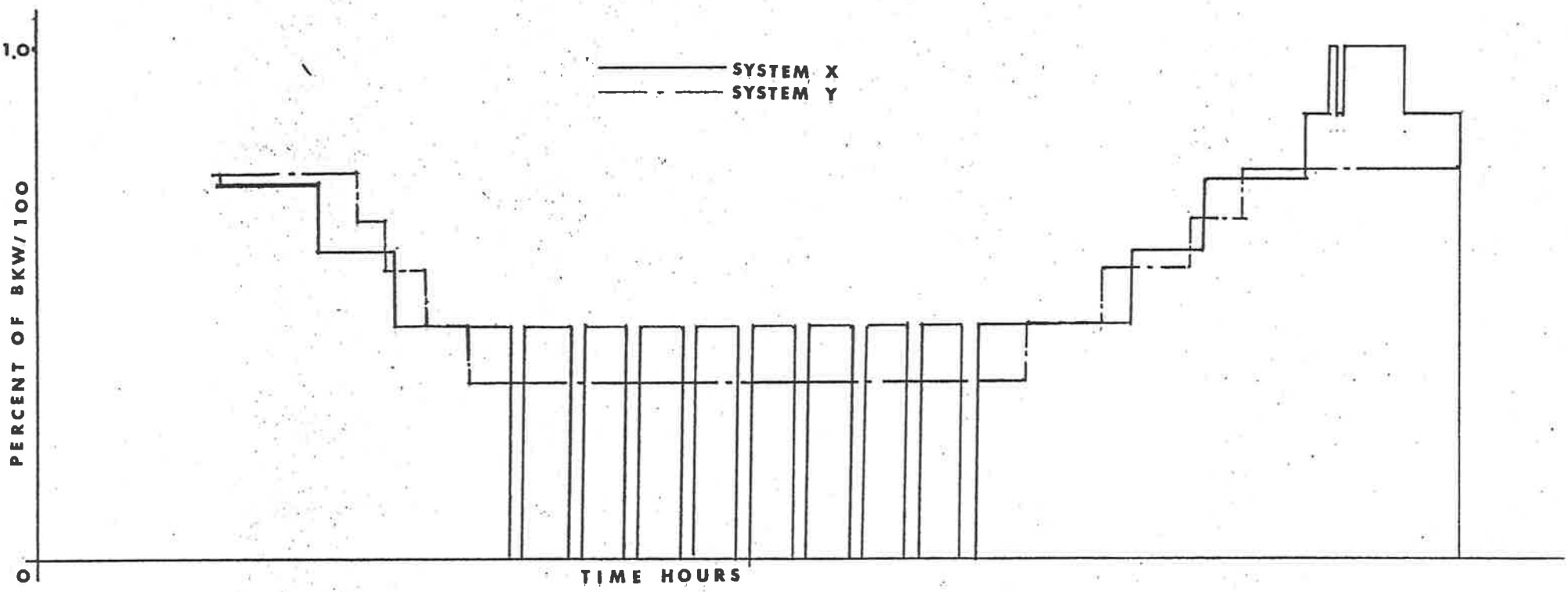
AIR QUANTITY L/S	AIR ON °CDB	AIR ON MC GM/KG.DA	AIR OFF °CDB	AIR OFF MC GM/KG DA	AVE. METAL SURFACE TEMP °C	METAL SURFACE AREA M²	AIR VELOCITY M/SEC	AIR MASS FLOW KG.D.A/SEC	LOG MEAN TEMP. DIFF °C	TOTAL SENS. ENERGY TRANSFER WATTS	LENGTH OF METAL SURFACE M	HEAT TRANSFER W/M²°C	VAPOUR PRESS. DIFFERENCE KPA	MASS TRANSFER GM/SQ.M.SEC	TEMP. DIFF (ENT; AIR-METAL) °C
504	24·5	10·5	16·7	9·1	11·6	21·6	3·5	0·5879	8·40	4717	16·9	26·00	0·356	0·0381	12·9
458	24·4	10·9	16·4	8·7	10·4	21·6	3·1	0·5342	9·44	4397	16·9	21·54	0·511	0·0544	14·0
475	24·3	10·9	16·3	8·7	10·1	21·6	3·14	0·5543	9·65	4560	16·9	21·86	0·526	0·0566	14·2
382	22·9	10·9	14·7	8·3	9·3	21·6	2·65	0·4479	8·88	3759	16·9	19·6	0·559	0·0539	13·6
322	22·6	11·7	15·5	9·2	11·6	21·6	2·37	0·3773	6·85	2743	16·9	18·54	0·538	0·0437	11·0
279	23·2	11·4	14·6	8·4	9·8	21·6	2·15	0·3266	8·38	2879	16·9	15·91	0·586	0·0454	13·4
238	24·2	10·7	15·0	8·7	10·8	21·6	1·68	0·2778	7·93	2628	16·9	15·34	0·456	0·0257	13·4
204	24·7	11·1	15·5	9·1	12·0	21·6	1·48	0·2377	7·14	2252	16·9	14·61	0·434	0·022	12·7
190	21·7	11·1	13·0	8·0	9·9	21·6	1·35	0·2235	6·51	1984	16·9	14·11	0·598	0·0321	11·8
160	21·0	10·5	13·0	8·0	9·5	21·6	1·10	0·1890	6·72	1536	16·9	10·6	0·478	0·0219	11·5
95	20·1	11·1	12·5	7·8	9·7	21·6	0·53	0·1125	6·14	866	16·9	6·5	0·561	0·0172	10·4

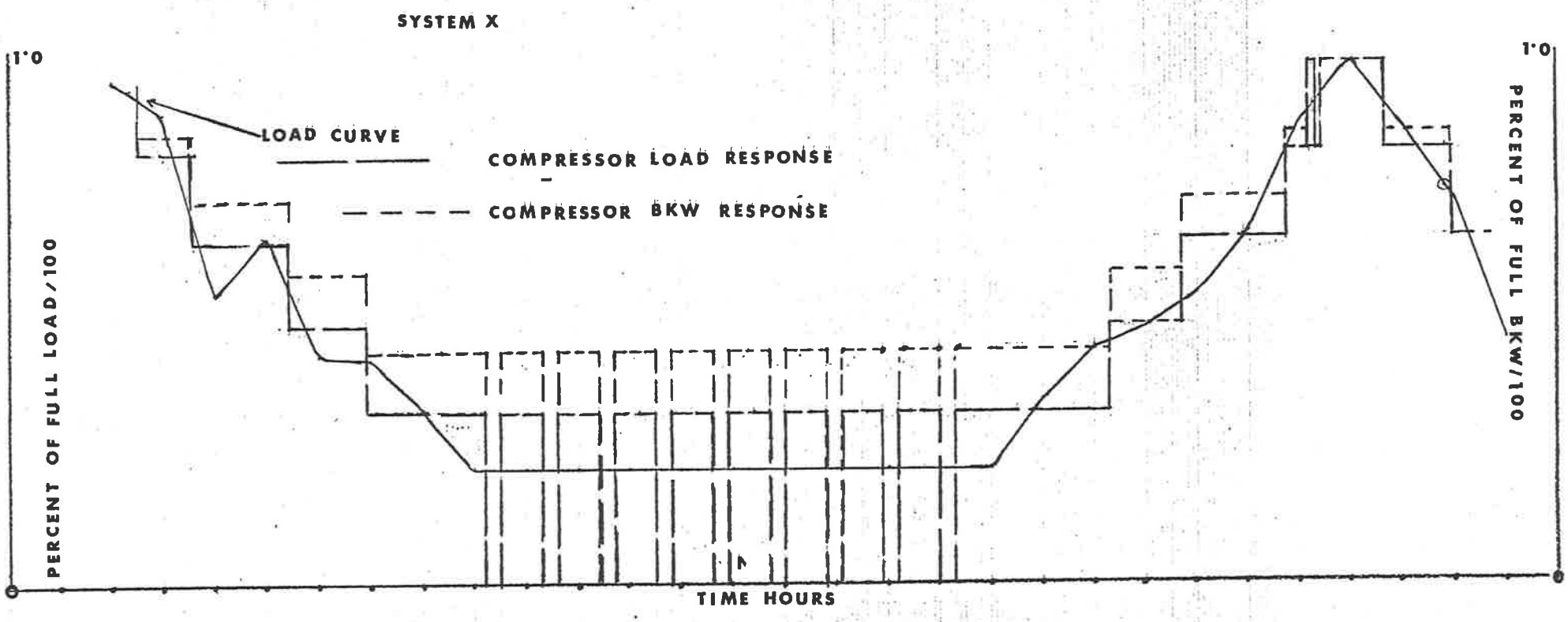

METAL SURFACE
COOLING AND DEHUMIDIFICATION
MEAN AIR VELOCITY, M/SEC
3·0
2·0
1·0
0·0381
0·0544
0·0539
0·0437
0·0454
0·0257
0·0220
0·0321
0·0219
0·0172
MASS TRANSFER RATE, GM MOIST/SQ.M.SEC
0·1
0·2
0·3
0·4
0·5
0·6
0·7
VAP. PRESS. DIFF, KPA
CENT. AIR - METAL)


METAL SURFACE
HEAT TRANSFER RATE, W/SQ.M. SEC
26·0
21·54
21·86
19·6
18·54
15·91
15·34
14·61
14·11
10·6
6·5
3·0
2·0
1·0
9·1
10
11
12
13
14
15
MEAN VELOCITY, M/SEC
TEMP DIFF (ENT AIR – METAL), °C

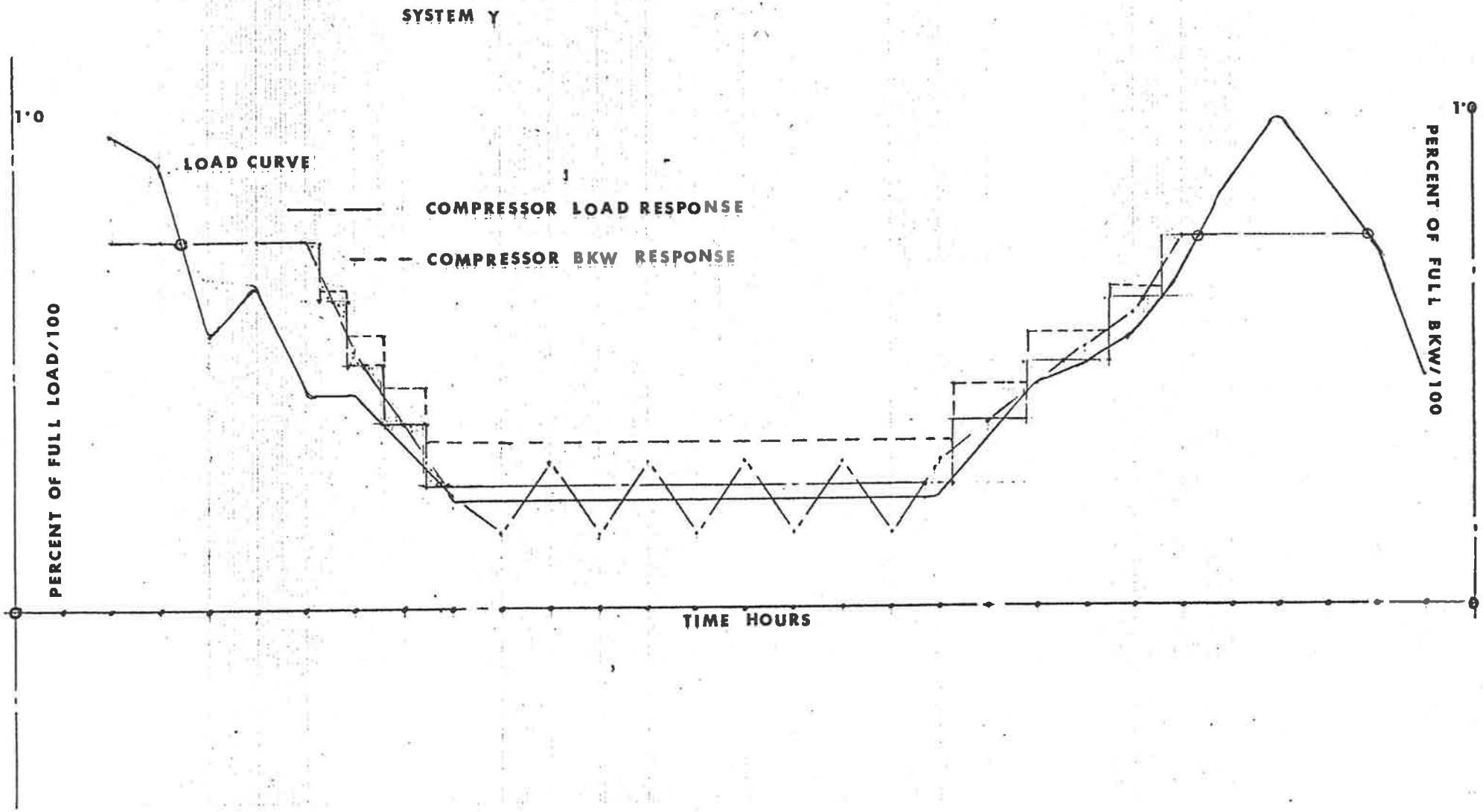
(C.1.3.5) LOAD AGAINST COMPRESSOR RESPONSE

SYSTEM X - CONVENTIONAL SYSTEM
SYSTEM Y - VESSEL/EXCHANGER SYSTEM


1.0
0
PERCENT OF BKW/100
SYSTEM X
SYSTEM Y
TIME HOURS


SYSTEM X
1·0
LOAD CURVE
COMPRESSOR LOAD RESPONSE
COMPRESSOR BKW RESPONSE
PERCENT OF FULL LOAD/100
TIME HOURS
1·0
PERCENT OF FULL BKW/100

(C.1.3.6) BRAKE KILOWATT CONSUMPTION FOR SYSTEMS X AND Y


SYSTEM Y
1·0
LOAD CURVE
COMPRESSOR LOAD RESPONSE
COMPRESSOR BKW RESPONSE
PERCENT OF FULL LOAD/100
1·0
PERCENT OF FULL BKW/100
TIME HOURS

(C.1.3.7) RECORDED TEST DATA FOR 46 DAYS

17-9-82	RD ER	RET AIR	WT SCRA	NET	LT OFF	WT CH	LEV AIR	NET	LEV AIR	RET AIR	WT SCRF	RD FR	DAMP	COAL	PUMP
0146	20	19	20	18	12	19	23	19	76	76	84	82	64	0	1
246	"	18	"	20	15	20	19	16	74	"	"	83	"		"
346	"	19	"	"	"	23	21	17	72	77	"	"	"		"
446	"	18	"	22	17	"	22	19	69	84	"	"	"		"
546	"	"	"	23	18	26	24	20	66	77	"	"	"		"
646	19	"	"	25	19	27	25	21	64	"	"	"	"		"
746	21	19	22	26	21	29	27	23	63	"	83	"	"		"
846	22	20	24	28	27	35	29	24	62	76	82	82	63		"
946	23	21	"	30	25	32	30	26	59	73	80	80	"		"
1046	24	22	27	35	27	35	33	27	"	"	86	81	68	6	0
1146	"	"	29	31	"	27	32	26	63	72	82	79	"	"	"
1246	"	"	"	"	26	28	35	"	61	69	80	26	67	"	"
1346	27	21	28	30	24	"	32	"	62	73	81	78	68	"	"
1446	24	"	"	"	23	27	35	"	"	20	80	77	67	"	"
1546	22	"	27	29	22	"	"	25	63	74	82	81	68	"	"
1646	"	20	"	"	"	26	31	24	65	76	84	83	"	"	"
1746	21	"	24	"	25	33	30	25	60	"	82	"	63	1	1
1846	27	22	25	31	26	"	31	27	59	72	81	81	"	"	"
1946	24	23	"	32	27	34	32	28	58	"	"	"	64	"	"
2046	23	"	26	33	"	"	34	29	56	71	80	"	"	"	"
2146	"	"	"	"	28	35	"	30	55	70	79	80	"	"	"
2246	27	"	"	34	29	36	"	"	54	69	"	79	"	"	"
2346	21	20	24	"	"	37	58	"	53	72	80	82	"	"	"
0046	20	19	"	"	30	38	"	"	"	74	81	83	"	"	"
18-9-82 0146	"	"	"	35	"	"	35	"	52	73	"	"	"	"	"
246	"	"	23	34	31	"	"	"	"	"	"	"	"	"	"
846	19	18	"	35	30	"	"	31	51	"	"	"	"	"	"
446	18	17	22	34	31	"	"	30	"	74	82	84	"	"	"
546	19	18	23	35	"	39	36	31	52	75	"	"	"	"	"
646	23	"	27	39	"	43	35	"	"	"	"	"	"	"	"
746	19	"	24	36	"	40	36	35	57	74	81	83	"	"	"
846	20	19	"	"	32	"	"	32	52	75	82	84	"	"	"
946	21	"	"	"	33	"	37	"	"	74	"	"	"	"	"
1046	22	20	25	"	"	41	"	33	57	72	81	82	"	"	"
NET 34768	19	19.5	"	37	39	41	32	32	37	61	79	58	ANR.	13,9 =	599
1146	21	20	"	"	32	41	38	"	53	72	"	82	64	1	1
1246	22	21	26	"	34	"	"	33	50	70	78	80	63	"	"
1346	24	22	27	28	"	42	39	"	"	67	77	79	"	"	"
1446	25	24	34	36	33	33	40	32	56	63	78	74	68	0	0
1546	22	21	33	35	29	34	39	38	55	66	77	75	"	"	"
1646	"	20	32	34	28	"	"	"	"	"	"	"	"	"	"
1746	21	"	25	36	32	40	37	32	48	68	76	78	63	1	1
1846	20	19	24	"	"	39	"	31	49	71	79	80	64	"	"
1946	21	20	"	"	"	40	"	32	50	"	"	81	"	"	"
2046	22	21	26	"	"	"	"	33	52	70	80	"	"	"	"
2146	21	20	25	"	33	"	"	32	50	"	79	"	"		"
2246	20	19	"	"	"	41	"	"	"	71	80	82	"		"
2346	23	18	24	"	"	"	"	"	51	74	81	84	"		"
0046	"	"	"	"	"	"	"	"	"	75	82	"	"		"

15-9-82	RA FA	ART RIR	WT SURF	HRT	WT OFF	W. ON	LEV RIA	HRT	LEV RIR	RET RIR	WT SURF	RA EN	DIAP	CONT	PUMP
0146	23	21	21	19	15	19	19	16	62	56	23	64	68	0	0
246	"	"	"	23	18	20	20	19	61	55	72	63	"	"	"
346	22	20	"	19	"	"	19	16	"	60	"	64	"	"	"
446	"	"	"	"	15	23	23	"	62	57	23	65	"	"	"
546	"	"	20	"	14	18	19	19	"	58	"	"	"	"	"
646	"	"	21	"	15	23	"	"	"	"	"	"	"	"	"
746	23	21	"	"	19	20	"	17	65	62	26	68	"	"	"
846	25	22	"	20	18	22	21	"	68	64	78	69	67	"	"
946	27	24	25	21	19	19	"	18	69	66	27	21	62	1	1
1046	28	25	27	"	16	15	"	"	70	65	73	70	61	"	"
1146	29	26	"	20	19	14	20	17	"	64	72	69	"	"	"
1246	"	"	28	"	"	"	"	"	"	62	71	68	60	"	"
1346	30	27	"	"	14	13	19	19	71	60	20	66	"	"	"
1446	"	"	"	19	"	"	"	16	"	61	"	"	61	"	"
1546	29	26	27	18	13	12	18	15	70	60	69	65	"	"	"
1646	28	25	26	"	12	11	17	14	71	61	"	66	"	"	"
1746	27	24	25	19	10	13	"	"	72	62	71	68	62	0	"
1846	26	27	24	"	11	"	19	"	72	63	22	69	"	"	"
1946	"	25	25	17	15	14	18	"	73	"	74	70	"	"	"
2046	28	26	26	19	12	"	19	19	72	61	72	69	"		"
2146	26	24	25	"	13	19	"	"	68	"	"	"	"		"
2246	"	"	23	"	"	12	18	"	68	"	71	68	"		"
2346	"	"	24	18	"	"	"	14	"	"	20	67	"		"
0046	"	23	"	17	11	11	17	"	69	"	"	"	"		"
16-9-82 0146	25	"	"	"	15	13	"	13	"	60	"	"	"		"
246	26	"	"	"	12	14	"	14	67	"	69	66	"		"
346	26	"	"	18	"	15	18	"	65	59	68	65	"		"
446	25	22	"	"	13	"	"	"	64	"	"	"	"		"
546	"	"	23	"	"	19	"	"	66	63	21	68	67	0	0
646	24	"	19	19	17	"	19	19	71	64	81	71	"	"	"
746	23	"	23	18	15	18	"	15	78	74	87	78	"	"	"
846	24	"	19	"	"	19	"	19	82	78	90	80	"	"	"
946	26	24	19	20	16	20	20	"	"	73	"	78	"	"	"
WET 1046 3/4/09	"	23	"	"	19	21	"	18	83	"	91	79	"	"	"
1146	25	23 27	23	"	16	20	20	19	84	51 74	"	"	AMB 20, 16.5-7.8		
1246	"	23	"	"	19	"	20	17	85	"	92	80	"	"	"
1346	"	"	"	"	"	21	"	"	83	72	90	79	"	"	"
1446	29	30	31	19	14	12	19	19	78	65	76	72	62	1	1
1546	28	25	26	"	"	"	18	"	86	72	82	79	61	"	"
1646	26	24	25	17	12	15	19	14	"	73	"	78	"	"	"
1746	25	27	24	"	14	11	"	13	88	75	84	81	"	"	"
1846	"	23	19	"	12	14	15	14	87	76	88	82	67	0	0
1946	24	"	17	18	14	"	19	15	88	77	95	83	"	"	"
2046	23	21	16	17	12	16	17	"	89	76	96	82	68	"	"
2146	22	21	19	19	11	"	16	14	90	"	95	83	"	"	"
2246	21	20	17	17	"	17	19	"	"	"	"	82	"	"	"
2346	"	"	20	19	9	18	15	12	"	75	86	"	63	"	1
0046	20	19	"	16	10	17	17	13	92	76	85	"	64	"	"

22-3-82	RA FR	RET AIR	WISURA	MAT	WEOFF	WTON	LEV AIR	MET	LEV AIR	RET AIR	WISURA	RD FR	DRIFTAL
0145	35	28	28	18	19	10	23	15	70	57	68	63	60
245	31	27	28	18	14	10	22	15	69	63	71	63	61
345	31	28	28	23	13	11	22	15	72	65	69	68	"
445	30	28	28	19	14	13	22	19	72	69	70	69	56
545	30	28	28	23	19	13	22	19	73	66	75	68	61
645	30	27	27	20	17	14	22	19	22	71	74	69	"
745	27	26	26	18	17	11	20	19	86	94	91	86	"
845	27	25	25	19	15	11	21	15	87	96	92	88	60
945	26	24	24	17	19	10	19	14	90	95	92	92	61
1045	25	24	24	17	15	9	19	13	86	94	92	87	"
1145	25	25	27	16	12	15	23	13	87	87	91	85	62
1245	23 27	23.5 25	25	18	14	12	15 21	14	85 83	62 92	86	69 83	57
1345	28	26	25	18	19	13	22	19	84	77	86	80	62
1445	27	25	25	19	19	11	21	15	84	81	83	83	61
1545	27	26	25	23	15	10	21	19	79	83	84	79	59
1645	27	25	25	18	15	10	20	12	81	81	87	79	61
1747	26	25	24	17	14	9	20	14	83	87	84	84	56
1547	26	24	23	19	13	11	19	13	80	86	85	80	59
1947	25	24	24	17	14	12	20	14	84	80	87	81	62
2047	23	27	22	17	14	13	19	14	81	87	86	83	59
2147	24	23	23	18	19	10	20	14	84	92	88	87	57
2247	27	22	17	23	19	15	27	19	84	82	95	86	68
2347	"	"	"	20	16	19	23	17	83	85	94	88	62
0047	23	21	16	20	18	15	22	17	80	85	96	85	66
23-3-82 0147	22	21	16	19	"	14	"	16	81	88	97	84	63
247	"	"	"	23	17	"	"	17	79	86	"	84	"
347	"	20	19	19	18	"	"	15	81	76	98	83	68
447	21	"	17	"	"	"	21	19	77	80	97	81	"
547	"	"	16	"	17	"	"	16	81	79	"	85	"
647	20	19	20	17	14	17	17	14	80	83	87	82	59
747	21	20	21	18	16	19	19	19	79	72	85	78	63
847	22	21	22	21	19	22	21	17	78	72	80	79	"
947	24	22	21	22	22	"	24	19	72	74	90	75	67
1047	25	27	24	21	22	19	23	23	77	68	79	78	62
1147	25	24	25	21	19	14	22	17	71	70	77	73	60
1247	26	24	24	20	17	12	21	19	73	73	74	73	57
1347	26	24	25	23	19	11	21	19	74	64	73	74	61
1447	26	23	23	18	19	10	20	14	72	61	70	70	"
1547	25	"	27	19	14	9	23	13	70	59	68	69	"
1647	24	"	"	"	12	10	19	13	76	68	75	75	59
1747	23	22	17	"	14	12	23	19	77	73	91	80	67
1847	22	21	19	18	15	14	22	19	70	62	93	74	68
1947	21	20	"	"	19	13	21	15	66	73	92	73	62
2047	20	19	23	19	12	19	17	12	73	72	75	74	58
2147	20	"	19	17	14	17	18	13	68	67	73	70	62
2247	20	18	19	"	16	"	18	14	72	68	"	25	64
2347	23	17	23	18	"	20	23	15	68	73	72	72	58
0047	"	18	19	20	19	20	20	16	68	70	74	71	63

M-3-82	RA FTR	ABF AIR	WT SUMP	MIST	WT OFF	WT ON	LEV 12 IR	MIST	LEV AIR	RET AIR	WT SUMP	RA FTR	DAMPER
0142	22	20	19	18	16	14	22	19	22	23	94	28	62
242	22	20	15	19	17	14	21	19	72	73	95	28	68
342	22	20	15	19	18	14	22	19	68	71	96	72	"
442	22	20	14	19	23	14	22	19	66	67	96	69	"
542	22	20	19	19	18	14	22	16	63	68	95	68	64
642	22	19	15	19	18	14	22	19	62	61	95	65	68
742	24	22	16	19	19	19	24	17	58	63	95	64	64
842	26	23	21	23	17	12	21	19	60	61	88	62	61
942	31	24	25	18	19	9	21	13	65	64	65	64	57
1042	29	27	26	18	19	9	21	14	67	55	68	61	61
1145	30	31	30	18	15	8	21	14	67	64	65	63	56
20-3-82	26.5	25.5			11	9	15.5		75	37		38	
1245	33	30	30	23	19	11	24	19	64	43	52	46	60
	30	28			12	10	17		64	32		30	
1345	34	31	31	20	16	10	23	19	54	40	52	46	54
1445	34	30	35	19	15	12	23	16	57	40	52	48	60
1545	35	35	35	20	19	13	25	17	54	47	49	49	55
1645	35	35	35	21	16	14	24	17	54	47	52	50	56
1745	33	31	31	21	23	12	24	18	56	47	54	52	58
1848	30	28	27	20	17	14	23	19	63	57	64	69	61
1945	30	26	27	19	16	10	22	14	63	64	59	60	60
2045	29	26	27	18	19	10	22	15	58	53	55	55	57
2148	30	27	27	17	14	12	21	15	59	44	57	53	61
2245	29	26	27	18	15	13	21	14	59	43	55	53	"
2345	29	25	26	19	15	13	21	19	56	52	53	54	57
0045	29	26	27	20	19	13	21	15	52	50	52	67	"
21-3-82													
0145	29	26	27	19	16	12	22	19	52	48	49	52	56
0245	28	26	27	19	16	11	22	19	51	42	51	47	61
345	28	25	27	18	19	9	21	15	67	36	50	46	"
445	28	26	27	18	13	12	20	15	52	38	47	47	"
545	28	26	26	17	14	11	21	14	48	40	46	46	57
645	27	24	26	18	14	13	20	15	49	29	45	44	61
745	29	26	27	18	19	13	22	15	44	35	39	42	56
845	31	28	27	20	19	13	23	17	47	38	43	44	61
945	35	29	29	20	18	12	23	17	52	35	47	44	"
1045	35	35	35	21	18	12	24	17	51	47	46	47	55
1145	35	35	35	21	17	13	25	19	60	48	58	52	60
1245	"	"	"	21	17	12	25	19	60	47	54	52	59
1345	34	"	"	"	"	15	24	17	62	62	57	57	55
1445	39	"	"	20	"	11	24	17	61	60	60	52	58
1545	35	"	30	"	"	11	24	17	68	59	65	63	60
1645	33	31	"	19	19	10	23	19	67	65	69	62	61
1745	32	29	29	23	"	"	"	"	69	70	71	66	58
1845	35	28	27	19	15	"	22	"	70	67	69	68	56
1945	35	"	"	18	14	12	"	15	70	68	73	"	58
2045	35	29	28	20	19	14	23	16	67	61	70	62	61
2145	"	"	29	"	15	13	27	19	68	68	67	65	56
2245	"	28	30	"	19	12	"	17	66	64	"	62	57
2345	"	29	29	19	17	15	27	16	70	59	67	64	60
0045	"	28	29	19	16	11	23	19	68	56	66	62	"

17-3-82	RM FR	RM AIR	WT SURF	MET	WT OFF	WT ON	LIVING	MET	WET AIR	RET AIR	WT SURF	RM FR	DAMPER
0142	24	23	22	19	12	12	18	13	82	73	82	79	62
242	24	22	22	17	14	13	19	13	84	76	83	81	"
342	24	22	16	19	19	19	24	17	77	85	94	81	"
442	23	21	19	19	17	15	27	19	80	78	95	84	68
542	24	22	16	20	17	15	27	17	76	84	95	81	63
642	23	22	19	19	18	15	27	17	75	80	95	79	66
742	23	22	19	20	18	19	24	18	77	79	96	82	67
842	25	27	17	21	20	16	25	19	77	70	98	79	"
942	26	25	23	18	16	15	20	14	78	73	81	78	62
1042	31	25	24	18	19	10	20	14	77	73	78	76	61
1142	28	26	25	18	19	9	21	14	75	73	75	73	56
1242	28	26	26	19	14	12	21	14	76	68	76	74	61
1342	28	26	26	18	14	12	21	15	73	63	77	69	"
1442	27	26	26	18	19	14	21	14	76	62	75	71	"
1542	31	25	25	19	19	14	21	19	73	70	73	71	67
1642	27	25	25	18	19	15	21	14	74	64	73	73	61
1742	26	24	24	17	19	9	20	14	78	74	80	78	57
1842	24	21	22	19	13	11	18	12	72	69	76	71	61
1942	27	22	19	19	15	14	23	16	68	69	93	71	67
2042	23	21	19	19	19	14	27	16	69	72	94	73	"
2142	23	21	19	19	17	14	23	15	70	77	93	76	61
2242	22	21	19	19	17	14	22	16	71	75	94	76	67
2342	22	21	14	18	17	14	22	19	76	72	84	79	68
0042	21	20	19	19	16	14	22	16	72	74	93	77	61
18-3-82 0142	21	20	19	23	17	15	21	16	70	73	92	75	"
242	21	19	19	17	17	14	21	19	73	66	95	75	68
342	21	18	19	19	14	18	18	13	77	70	79	78	63
442	20	19	20	18	16	20	19	19	74	72	78	77	"
542	20	19	20	20	18	21	20	16	70	74	77	74	60
642	20	18	21	19	19	25	20	16	74	72	77	78	63
742	21	19	22	22	21	26	21	20	71	67	77	73	"
842	27	21	27	25	23	29	24	21	66	74	74	73	58
942	24	22	25	25	26	27	23	21	69	66	84	71	67
1042	25	23	26	26	27	22	26	21	71	66	75	72	62
1142	28	25	31	25	25	23	26	21	70	65	75	70	61
1242	29	26	28	24	23	17	25	20	72	61	73	71	"
1342	29	27	28	22	22	19	24	19	73	59	72	70	"
1442	30	27	28	21	20	14	24	18	69	61	72	65	"
1542	29	31	27	21	19	12	27	18	68	67	68	67	57
1642	28	25	26	19	17	12	22	19	72	59	70	69	61
1742	26	23	25	18	19	10	20	14	75	64	76	71	"
1842	24	22	22	17	13	9	18	13	79	76	79	79	57
1942	23	22	16	19	15	13	23	16	73	68	94	76	67
2042	23	21	19	18	19	14	23	16	72	69	96	75	68
2142	22	20	19	19	17	14	22	19	75	79	95	79	"
2242	22	21	15	18	17	14	22	19	73	67	95	76	"
2342	22	22	19	17	17	14	22	19	74	72	96	79	"
0042	22	20	19	19	18	14	22	15	69	76	95	76	64

13-3-82	RA FR	REF AIR	WTSURF	HHT	WTCFR	WTCN	CHW AIR	HET	LEV AIR	REF AIR	WTSURF	RA FM	DAMPER
0142	22	20	19	20	18	14	22	16	72	81	93	78	61
242	22	21	18	19	18	16	22	17	74	82	95	78	63
342	22	20	19	20	18	19	22	16	76	79	95	77	65
442	22	20	19	19	19	15	22	17	74	80	95	78	67
542	22	20	19	18	18	16 73	23	17	73	79	96	78	"
642	21	20	19	20	23	15	22	19	73	76	95	76	68
742	24	22	16	21	19	16	23	18	68	79	93	75	61
842	26	24	24	18	16	11	20	15	72	72	76	73	57
942	26	24	25	18	19	10	21	14	73	77	80	74	59
1042	28	25	25	18	19	11	21	14	74	77	76	73	56
1142	30 27	27 26	26	18	14 11	10 9	22 16	15	73 76	68 48	74	72 47	61
1242	35	29	28	19	19	9	22	15	73	61	75	68	60
1342	35	28	27	18	15	11	22	14	74	60	75	69	61
1442	32	29	28	19	19	9	22	15	70	68	74	67	60
1542	31	28	27	18	14	11	21	15	70	69	74	68	58
1642	31	28	28	18	14	13	22	19	68	67	71	66	56
1742	29	26	27	18	14	14	21	19	71	68	20	69	55
1842	28	25	25	19	19	13	21	15	79	71	54	77	61
1942	27	24	25	18	15	11	21	19	79	68	80	76	61
2042	26	24	24	18	16	10	20	14	74	77	78	74	57
2142	26	24	23	17	14	9	19	13	76	78	77	76	57
2242	26	24	24	16	13	11	23	13	74	76	78	73	58
2342	26	27	24	17	14	13	20	13	76	70	76	75	62
14-3-82 0042	26	22	24	19	19	13	20	14	75	66	78	72	"
0142	25	23	27	17	14	14	20	14	73	72	77	71	"
242	25	23	22	17	19	14	20	14	74	75	74	73	56
342	26	22	22	17	15	10	23	13	76	65	76	73	62
442	25	27	23	16	14	9	18	13	76	64	76	72	"
542	25	22	23	19	12	11	18	13	73	69	76	70	"
642	25	21	23	16	12	12	19	13	73	70	72	72	57
742	27	24	24	17	14	12	19	14	72	73	71	71	56
842	29	26	26	19	19	14	22	19	68	63	72	65	62
942	30	31	28	20	17	12	23	16	70	68	73	66	61
1042	35	29	29	20	17	12	23	16	71	58	69	62	60
1142	35	30	30	20	17	12	24	17	65	63	64	61	55
1242	34	30	31	20	17	12	24	17	64	64	66	67	59
1342	35	35	38	19	17	12	24	17	62	47	62	54	"
1442	34	31	35	21	16	12	24	16	60	45	56	54	"
1542	35	35	35	20	19	11	24	17	59	44	53	53	"
1642	35	30	35	20	19	15	23	19	55	46	55	50	57
1742	34	30	30	23	19	11	23	16	60	47	52	55	"
1842	31	27	27	18	13	12	22	15	67	58	64	63	58
1942	29	31	27	18	14	12	21	15	67	64	69	64	59
2042	29	27	31	19	15	14	22	19	69	58	66	65	61
2142	28	26	27	23	19	14	22	19	66	64	66	64	57
2242	29	26	26	18	17	11	22	19	69	55	68	64	61
2342	29	26	27	19	19	11	22	17	71	62	69	69	57
0042	29	26	26	17	15	11	21	14	68	60	66	66	61

11-3-82	RM FA	REF AIR	WT SURF	MET	WT OFF	WT ON	LAU AIR	MET	LAU AIR	REF AIR	WT SURF	RM FA	DRAIN
	20	19	26	23	18	20	21	23	83	91	81	85	62
0142	20	20	22	26	26	31	25	23	77	84	79	84	58
0242	21	19	27	27	28	32	26	24	77	82	79	85	59
0342	21	19	23	28	29	33	26	25	76	73	81	82	64
0442	21	20	24	29	30	35	27	26	76	79	80	85	"
0542	21	20	24	30	35	36	28	27	~~77~~ 75	77	82	82	"
0642	22	20	24	32	33	38	29	28	73	85	80	83	58
0742	23	21	29	29	32	36	25	24	82	79	83	85	65
0842	24	21	32	29	26	31	24	24	78	89	78	84	62
0942	24	22	32	29	25	30	24	24	77	87	77	83	"
1042	24	22	33	29	25	28	24	24	75	83	75	80	"
1142	24	22	32	28	24	28	24	24	78	86	75	82	61
1242	25	23	32	29	25	28	24	25	75	72	77	78	67
1342	27	25	28	31	33	27	30	27	72	76	78	77	61
1442	27	26	28	29	30	27	29	25	76	70	77	79	"
1542	27	25	28	27	28	20	27	23	76	76	80	78	"
1642	26	25	27	25	25	18	25	21	76	82	79	80	56
1742	25	23	24	27	23	19	27	18	82	79	82	84	61
1842	24	23	23	21	21	14	21	17	83	88	83	85	56
1942	23	22	23	20	19	12	21	17	86	80	86	85	62
2042	24	22	22	19	17	11	20	19	82	88	86	84	58
2142	27	21	20	23	19	12	23	17	81	82	86	83	67
2242	23	21	17	19	17	17	23	17	81	85	95	84	"
2342	23	21	17	20	18	17	23	18	81	85	93	86	62
0042	23	21	17	20	18	19	23	17	79	88	92	84	64
12-3-82													
0142	27	22	16	20	18	19	22	17	82	79	94	85	67
0242	22	20	16	18	19	19	21	19	83	79	94	85	68
0342	22	20	17	23	19	19	22	17	83	80	95	86	"
0442	22	20	18	19	23	16	21	17	83	80	94	86	"
0542	21	20	16	19	19	16	22	17	84	82	93	86	"
0642	22	20	17	19	19	16	23	17	84	83	96	87	"
0742	23	21	19	20	18	16	23	19	79	89	95	84	62
0842	24	22	17	20	21	17	23	19	81	86	85	82	57
0942	24	23	23	19	19	11	21	16	83	79	87	81	62
1042	25	23	24	18	16	10	19	19	81	83	86	80	61
1142	25	23	24	18	19	10	21	14	82	91	86	83	57
1242	25	22	27	16	19	10	20	13	79	86	85	80	59
1342	24 / 23.5	24 / 22.5	24	18	15 / 11	9 / 11	19 / 15	14	80	69		65	
1442	26	23	24	19	14	12	19	14	82	86	87	82	61
1542	27	24	24	18	14	13	20	14	83	56	84	83	56
1642	25	23	24	17	15	14	20	16	81	77	86	79	62
1742	26	23	24	18	19	14	20	19	82	81	83	83	56
1842	25	22	27	18	14	11	20	14	81	84	82	82	"
1942	24	21	22	17	14	9	18	13	82	81	83	84	62
2042	23	21	19	23	15	19	23	17	79	81	94	84	67
2142	23	21	19	19	17	19	23	16	76	78	96	78	"
2242	22	21	19	23	17	14	22	16	73	79	94	78	64
2342	22	20	19	19	18	15	21	16	78	78	94	83	68
0042	22	21	15	18	18	15	22	17	76	77	97	78	62

COPY 8

9-5-82	RA FA	RET AIR	WISCR	REC	WICFE	NICN	LEV AIR	MET	LEV AIR	RET AIR	WISCR	RA FA	DAMPER
0140	21	19	19	18	16	14	20	15	71	69	82	76	68
0240	21	19	19	18	16	14	20	19	72	65	90	74	"
0340	20	18	16	18	17	14	20	15	69	72	88	73	67
0440	20	19	20	17	14	17	17	13 ~~20~~	70	62	75	71	64
0540	20	23	20	18	15	19	18	14	64	65	71	67	"
0640	19	18	19	19	17 ~~24~~	28	25	15	69	63	75	71	"
0740	21	20	21	21	20	22	21	17	67	65	69	72	63
0840	21	19	22	22	21	25	22	19	62	67	67	68	57
0940	22	21	22	23	25	26	23	19	56	66	73	66	62
1040	23	21	23	23	23	24	23	20	65	67	75	71	67
1140	23	21	24	23	24	23	23	20	62	65	77	68	"
1240	22	21	23	27	27	27	23	20	66	64	78	68	"
1340	23	22	24	24	24	23	24	20	63	66	76	67	66
1440	24	23	24	24	24	23	24	20	65	70	74	70	62
1540	23	22	24	23	23	23	24	20	66	70	79	70	67
1640	24	22	24	24	22	27	23	20	68	65	80	70	"
1740	23	21	24	27	22	24	23	20	68	69	80	72	"
1840	22	20	24	22	21	23	22	19	65	75	76	74	62
1940	22	19	27	21	21	23	22	18	65	72	73	73	61
2040	21	20	27	22	21	21	21	18	66	63	77	72	68
2140	21	20	23	21	21	22	21	18	66	68	78	71	"
2240	21	20	23	21	20	21	21	18	66	69	78	71	"
2340	20	19	23	21	20	21	21	17	67	69	78	71	"
0040	21	19	23	21	20	21	20	18	74	68	78	75	"
10-3-82 0141	21	23	22	21	19	21	21	19	73	72	77	77	"
0241	20	19	21	23	21	25	22	19	71	76	73	77	57
0341	20	19	21	23	22	26	23	20	71	76	74	77	58
0441	20	23	22	25	24	28	24	22	72	72	79	77	64
0541	20	19	23	27	25	30	25	23	76	80	79	84	"
0641	20	23	23	27	27	31	26	23	74	84	81	82	61
0741	21	20	23	28	29	34	27	25	73	83	80	81	"
0841	22	21	28	27	28	31	21	22	75	82	80	81	63
0941	22	20	28	27	22	26	22	22	79	84	80	82	67
1041	22	21	29	27	21	24	22	22	82	77	80	83	"
1141	22	21	29	25	22	23	22	22	81	89	81	81	64
1240	24	21	29	26	22	27	24	23	82	76	81	83	67
1341	24	21	29	27	27	24	24	27	79	77	82	81	"
1441	24	21	29	27	22	27	27	22	80	90	81	85	63
1541	24	27	29	26	22	27	23	22	84	85	86	85	67
1641	27	21	28	26	22	27	24	22	82	89	83	82	66
1741	23	21	28	25	21	23	23	22	85	88	86	87	68
1841	22	21	28	26	21	22	22	21	82	90	83	87	66
1941	21	21	28	25	20	22	22	21	85	87	86	88	68
2041	23	20	25	25	19	22	22	20	87	94	85	92	62
2141	22	20	27	24	23	22	21	19	86	94	84	90	"
2241	21	20	27	23	19	21	21	19	88	85	85	90	68
2341	21	19	27	24	19	21	21	20	82	92	83	87	63
0041	21	20	26	24	18	21	21	19	84	93	82	89	62

3-3-82	RR FR	REF AIR	WTR SURF	HAT	WTR OFF	WTR CK	LAV AIR	HET	LAV AIR	REF AIR	WTR SURF	RR FR	DAMLER
0136	22	20	20	20	20	18	22	18	64	71	28	70	62
0236	21	23	20	20	18	17	21	17	66	68	80	69	68
0336	21	20	20	20	19	18	21	17	63	70	77	68	62
0436	22	20	20	20	20	18	22	17	60	68	76	66	"
0536	22	20	20	20	20	18	22	18	60	64	77	64	66
0636	22	20	20	20	21	18	22	18	61	60	75	66	67
0736	24	22	20	22	22	19	24	19	52	61	75	60	62
0836	26	27	25	21	19	18	22	18	60	50	62	57	"
0936	28	25	26	22	20	18	24	19	55	55	58	55	59
1036	31	31	29	27	21	20	25	20	52	42	48	51	61
1136	35	29	29	23	22	20	26	21	49	44	46	48	60
1236	32	29	30	24	21	21	26	21	43	36	41	42	56
1336	32	29	35	25	22	21	28	22	52	38	51	47	60
1436	34	29	35	25	23	22	28	22	48	46	48	47	56
1536	35	29	31	26	23	22	27	23	51	32	48	46	60
1636	33	30	35	26	24	22	27	22	49	44	50	48	59
1736	35	29	30	25	24	22	28	22	50	45	52	50	"
1836	29	27	29	25	24	23	26	22	57	46	55	58	61
1936	28	26	28	24	23	23	25	21	63	55	62	63	"
2036	28	25	27	25	23	22	26	21	55	49	59	56	"
2136	27	24	26	25	23	22	25	20	54	52	57	56	60
2236	26	25	27	24	27	23	26	21	56	42	56	55	62
2336	27	25	26	25	23	23	25	20	57	51	52	54	57
0036	27	24	27	24	22	27	25	21	53	46	52	52	61
4-3-82													
0136	26	24	25	24	27	27	28	21	54	43	56	54	62
0236	26	26	26	24	27	23	25	21	56	43	56	55	"
0336	27	25	27	24	24	22	25	21	54	53	57	56	61
0436	26	23	25	24	23	22	25	21	57	56	61	59	62
0536	25	22	24	27	23	22	24	19	60	54	65	62	"
0636	24	22	24	27	23	22	24	19	64	58	68	65	"
0736	26	24	27	23	23	22	21	21	62	61	66	63	"
0836	28	27	27	25	22	22	25	21	59	60	63	61	60
0936	31	29	30	26	24	27	27	22	64	60	68	62	61
	29	28			22	20	24		50	43		39	
1036	33	30	35	26	24	19	25	23	60	54	58	60	56
1136	36	35	32	26	24	19	28	21	57	54	55	56	"
1236	34	32	34	25	27	18	28	21	54	45	50	51	57
1336	36	33	33	25	22	18	28	22	52	33	48	45	59
1436	37	32	34	21	21	17	28	21	48	36	44	41	"
1536	37	33	33	25	21	19	27	21	44	25	42	37	"
1636	36	33	33	24	20	19	31	19	44	32	38	42	56
1736	35	32	33	27	19	19	26	23	45	34	42	41	55
1836	35	30	30	21	18	13	24	18	55	44	55	50	60
1936	30	27	28	20	16	10	22	16	58	48	59	54	"
2036	30	27	28	19	16	11	22	19	56	40	54	51	61
2136	30	31	27	23	14	10	22	19	50	41	50	46	"
2236	30	27	27	18	14	10	21	14	52	38	47	49	"
2336	29	27	27	18	13	11	21	19	52	39	46	48	"
0036	30	26	27	17	13	12	20	15	50	45	46	52	57

1-3-82	RA FA	RET AIR	WTSURF	MIET	WT OFF	WT ON	LEV AIR	MIET	LEV AIR	RET AIR	WTSURF	RA FA	DAMPER
0136	20	18	19	17	16	13	20	14	62	62	85	70	68
0236	20	18	19	18	16	13	20	14	64	65	85	71	"
0336	21	18	15	18	17	14	20	19	63	60	87	68	"
0436	20	19	16	19	17	14	20	15	60	68	85	67	63
0536	21	18	15	18	17	14	21	19	64	62	84	69	68
0636	21	19	19	18	18	14	20	19	67	63	87	71	"
0736	21	19	16	18	18	14	21	19	65	64	89	70	"
0836	22	19	15	18	18	14	22	16	66	74	87	72	61
0936	23	21	19	19	20	19	23	15	65	73	89	71	62
1036	24	22	19	20	20	17	24	18	70	69	90	75	67
1136	25	23	16	21	19	16	25	19	71	66	94	74	"
1236	25	23	16	21	20	16	25	18	73	77	92	78	61
1336	25	23	15	22	21	18	25	23	68	76	93	74	"
	23	22			12	9	15		80	57		55	
1436	26	24	24	17	14	9	20	14	69	73	75	70	57
1536	25	22	23	17	13	8	23	12	72	72	78	71	61
1636	25	22	23	19	12	11	19	13	76	75	82	75	62
1736	24	22	22	19	12	11	18	13	75	69	77	75	"
1836	24	22	19	19	15	19	23	16	70	68	91	74	67
1936	27	21	19	23	15	19	22	16	75	70	93	77	"
2036	22	21	19	19	17	19	27	16	75	73	92	79	68
2136	22	21	19	23	18	14	22	19	74	77	94	77	"
2236	22	20	19	19	16	15	22	16	73	81	92	78	61
2336	22	19	19	18	18	14	21	16	71	68	93	75	68
0036	22	19	19	18	17	15	21	19	72	71	92	77	"
2-3-82													
0136	20	19	19	18	19	14	20	15	67	74	92	73	62
0236	19	18	18	19	13	12	17	12	78	68	83	76	63
0336	19	18	18	19	13	13	16	11	75	73	76	77	57
0436	23	17	19	19	14	13	16	12	74	65	76	74	64
0536	19	17	18	18	13	13	17	12	70	75	74	73	57
0636	19	17	18	19	13	13	17	12	69	62	75	70	63
0736	20	18	23	16	14	14	19	13	68	71	23	71	58
0836	21	19	20	17	15	14	18	13	70	72	71	72	57
0936	23	21	18	23	20	17	24	17	62	65	85	66	67
1036	25	27	17	21	23	19	24	19	64	60	58	67	"
	23	22.5			15	15	16.5		68	45		42	
1136	27	23	24	19	17	16	21	15	64	64	69	64	60
1236	27	25	25	19	16	19	21	16	63	63	64	64	56
1336	28	25	26	22	18	17	22	19	63	48	63	60	61
1436	28	26	27	21	19	17	27	18	56	53	57	55	57
1536	28	26	25	22	23	17	24	19	56	47	55	52	61
1636	29	25	31	21	23	18	24	18	57	48	59	55	"
1736	27	25	26	22	19	18	23	18	57	58	58	58	56
1836	26	27	24	20	23	23	22	18	63	58	67	62	62
1936	23	22	21	21	19	19	27	18	64	60	75	69	"
2036	24	21	21	21	19	19	23	18	64	61	81	68	65
2136	22	21	21	21	19	18	27	18	69	64	81	72	"
2236	23	21	21	21	20	18	23	18	67	62	81	70	"
2336	22	20	20	21	20	18	23	18	65	64	82	68	"
0036	23	21	20	20	20	18	23	18	64	72	78	69	61

27-2-82	RQ FD	RET AIR	WCSHR	HOT	WTOFF	WTON	LEV AIR	WET	LEV AIR	RET AIR	WTSHR	AD FD	DOWNER	
0135	20	18	16	17	19	13	20	16	57 75	61	81	63	64	
0235	23	18	16	17	15	14	20	14	58	60	77	64	61	
0335	19	18	16	17	14	13	18	14	59	57	77	66	65	
0435	18	19	16	19	13	13	18	13	55	62	74	64	61	
0535	18	17	18	16	12	16	17	12	60	58	64	65	59	
0635	17	16	18	16	15	19	17	13	58	54	63	64	64	
0735	19	17	19	18	17	21	19	19	55	50	65	59	64	
0835	20	17	21	20	23	19	20	16	57	53	62	62	63	
0935	22	20	21	21	20	20	21	18	56	59	72	62	64	
1035	23	21	21	22	21 19	20 19	22 20	18	51 44	56 41	71	57 41	62	
1136	20.5 25	20.5 24	23	22	22	15	23	19	51	44	67	54	"	
1236	27	24	25	21	20	15	27	18	51	48	55	52	59	
1336	27	25	26	20	23	14	22	19	47	43	50	48	57	
1436	28	25	26	20	18	12	22	19	48	37	47	48	61	
1536	28	25	26	19	16	11	21	19	48	44	50	52	57	
1636	27	24	25	18	15	9	21	15	53	50	53	52	56	
1736	25	27	24	19	13	8	23	13	55	53	58	54	60	
1836	23	21	16	17	19	13	27	16	58	64	80	63	61	
1936	22	20	19	18	15	14	22	19	60	65	85	65	64	
2036	21	20	15	17	16	14	21	19	64	73	86	70	62	
2136	20	19	15	18	16	13	21	19	67	70	86	73	"	
2236	21	19	19	18	13	13	20	15	65	63	88	70	68	
2336	21	23	15	18	16	13	20	14	68	68	87	74	"	
0036	19	19	15	17	18	13	20	15	68	67	89	71	"	
28-2-82 0136	19	18	14	17	17	14	20	15	67	64	88	71	"	
0236	20	19	15	17	19	13	20	14	67	75	89	73	63	
0336	20	18	15	19	17	13	19	15	72	71	89	76	68	
0436	20	18	19	16	16	13	23	15	70	72	86	75	66	
0536	18	19	15	16	18	13	18	13	65	69	76	70	"	
0636	19	17	15	16	19	12	18	14	68	64	87	71	68	
0736	20	18	15	17	19	13	19	14	64	64	88	68	"	
0836	21	23	19	17	18	14	21	16	61	58	87	66	"	
0936	23	21	15	19	19	19	23	19	62	65	87	68	62	
1036	26	22	15	20	20	19	25	18	57	63	88	64	61	
1136	27	24	24	17	15	9	19	14	65	51	66	62	"	
1236	31	26	25	17	14	11	23	13	59	46	62	54	"	
1336	28	25	26	18	13	12	21	14	64	46	63	58	"	
1436	28	26	25	18	14	13	20	14	62	56	65	58	"	
1536	29	26	26	18	14	14	21	15	67	58	66	66	"	
1636	28	26	26	23	19	14	22	19	70	65	69	70	57	
1736	27	24	25	19	16	11	21	15	67	53	68	64	61	
1836	24	23	23	17	13	9	19	13	71	57	72	69	62	
1936	22	20	15	18	14	14	21	15	64	70	86	69	61	
2036	22	21	19	17	14	14	22	16	67	58	87	69	65	
2136	21	20	19	18	19	13	21	19	62	64	87	66	"	
2236	20	19	19	17	19	13	20	19	64	62	88	68	"	
2336	20	23	15	17	18	13	20	14	64	65	89	70	"	
0036	19	18	19	17	15	13	23	14	66	64	84	72	"	

25-2-82	RO.EA	REF AIR	WTSURF	HEAT	WICOIL	WECON	LEV AIR	HEAT	LEV AIR	REF AIR	WTSURF	RO.EA	DAMPER	
0132	21	20	15	18	17	13	20	19	68	72	90	72	68	
0232	21	23	15	17	16	14	20	19	73	69	92	74	"	
0332	21	23	15	17	16	14	21	15	70	79	90	76	61	
0432	20	18	15	17	16	14	20	15	73	71	91	77	68	
0532	20	18	15	17	16	13	20	14	71	77	90	76	61	
0632	20	18	15	19	16	13	20	19	67	75	90	73	62	
0732	22	20	15	18	17	14	21	15	66	75	91	72	61	
0832	17	21	19	23	18	19	23	17	66	63	93	70	68	
0932	25	27	14	20	21	16	25	18	64	63	95	67	67	
1032	26	23	24	18	13	9	20	13	66	63	92	70	61	
1132	27	25	25	18	13	8	20	14	70	63	70	68	60	
1232	28	25	25	17	13	15	20	14	70	59	69	66	61	
1332	28	26	26	18	13	12	21	19	69	60	73	65	"	
1432	28	25	26	19	14	13	21	15	70	71	71	69	56	
1532	30	26	27	19	19	14	22	15	73	56	74	69	61	
1632	29	26	27	19	19	10	22	19	73	64	72	72	"	
1732	25	24	24	18	14	8	20	14	71	65	75	68	"	
1832	24	22	27	16	13	8	18	13	75	61	75	71	62	
1932	23	21	15	18	14	13	23	15	66	69	87	72	60	
2032	23	21	19	18	19	15	22	16	67	65	91	70	68	
2132	23	21	19	18	16	13	23	16	70	68	92	75	67	
2232	22	21	19	18	19	14	23	19	70	73	92	73	68	
2332	22	20	19	18	18	14	22	19	74	69	91	77	"	
0032	22	21	15	18	17	14	22	19	76	73	92	79	"	
26-2-82 0132	22	20	14	19	19	14	22	16	74	83	91	79	61	
0232	22	20	14	18	18	14	22	19	76	71	94	78	68	
0332	21	20	14	18	18	13	21	16	73	73	93	78	"	
0432	21	20	14	18	18	13	21	16	68	72	92	75	61	
0532	21	23	15	18	17	13	19	19	65	64	90	72	68	
0632	20	23	15	18	19	14	21	15	60	70	90	70	62	
0732	22	20	15	18	17	13	21	15	62	70	91	69	"	
0832	22	19	15	23	19	19	22	16	65	59	92	68	68	
0932	24	21	14	20	20	15	24	18	62	57	92	66	67	
1032	25	23	18	21	20	17	26	18	63	67	94	68	63	
1132	26	24	24	18	19	9	23	14	68	60	74	65	62	
1232	27	25	24	19	14	8	19	13	66	60	71	64	61	
1332	27	24	24	17	13	11	19	13	72	54	75	68	61	
1432	26	25	25	18	13	12	19	14	63	61	66	63	56	
1532	27	24	25	18	14	12	19	14	64	55	68	61	62	
1632	31	23	25	18	14	13	21	15	64	54	68	61	"	
1732	26	24	24	18	14	14	21	19	66	55	71	63	"	
1832	24	22	22	16	19	9	19	13	66	60	71	65	"	
1932	24	23	16	19	14	19	24	19	63	57	87	67	67	
2032	22	21	16	23	19	14	22	16	62	68	89	69	62	
2132	21	20	17	18	15	14	21	16	64	72	87	71	"	
2232	22	20	16	18	17	14	21	16	63	70	85	70	"	
2332	21	19	16	18	16	14	20	19	63	70	88	70	"	
0032	19	19	19	18	15	14	21	14	57	60	92	67	67	
		V	V		°C SA		°C MA	°C SA	°%RH MA	V	°%RH SA	V		

23-2-82	RA FA	RET AIR	WISURF	MET	WICOFF	WICON	LEV AIR	MET	LEV AIR	RET AIR	WISURF	RA FA	DAMPER
0132	24	22	21	17	13	8	18	12	81	85	82	81	56
0232	27	21	19	18	15	15	22	16	80	76	94	82	67
0332	23	21	15	18	19	15	22	19	81	76	95	82	"
0432	22	20	15	19	16	14	22	19	80	78	94	84	68
0532	23	20	15	19	17	15	22	17	78	74	94	81	67
0632	23	21	16	23	18	14	22	17	75	71	93	78	68
0732	27	22	15	19	19	15	24	17	73	81	95	78	63
0832	24	22	15	20	18	15	24	17	23	83	95	79	61
0932	24	22	19	20	20	16	24	18	74	68	96	26	67
1032	23 26	23 24	24	18	11.5 14	9 9	15.5 20	14	80 72	52 74	78	52 71	57
1132	26	24	24	18	12	8	23	14	76	75	78	76	61
1232	24	24	24	19	12	11	19	13	74	70	75	73	57
1332	28	26	25	17	13	11	19	13	67	66	70	65	56
1432	29	27	27	18	14	12	21	19	67	57	71	62	61
1532	28	26	26	23	14	13	21	19	75	63	74	72	61
1632	28	26	25	19	15	14	22	15	77	71	77	76	"
1732	27	25	25	23	15	10	21	19	73	73	75	72	56
1832	25	24	24	17	13	9	23	13	78	73	78	77	61
1932	24	22	22	16	13	7	18	12	75	74	81	74	62
2032	24	22	15	19	14	15	27	17	73	78	91	78	60
2132	23	21	15	19	19	13	22	19	75	71	93	78	68
2232	22	21	15	18	19	14	22	16	73	67	91	76	67
2332	22	20	15	18	19	13	22	19	72	69	93	75	68
0032	20	20	14	17	19	13	20	19	71	75	92	75	64
24-2-82 0132	21	19	14	18	16	13	21	15	70	73	91	76	60
0232	20	19	14	19	15	13	20	14	72	76	92	77	"
0332	20	19	14	17	16	12	20	14	72	80	93	77	62
0432	20	18	14	17	16	13	20	15	73	69	94	75	68
0532	20	18	14	19	15	12	19	14	71	70	92	76	"
0632	19	17	14	17	15	13	19	14	68	68	93	71	"
0732	21	19	14	18	16	14	21	15	64	69	92	71	"
0832	23	21	14	23	18	13	23	17	62	64	93	69	65
0932	24	21	15	20	23	15	24	18	61	66	96	67	66
1032	26	23	20	20	15	10	20	19	63	63	89	66	56
1132	31	25	24	17	14	9	20	14	67	64	69	66	"
1232	31	25	25	19	12	15	19	13	69	56	70	64	61
1332	29	26	25	18	13	12	20	14	68	53	67	64	"
1432	29	26	27	18	14	13	21	15	67	52	66	62	"
1532	29	25	26	18	14	13	22	19	67	50	68	62	"
1632	28	26	26	19	19	14	21	19	71	61	71	77	56
1732	28	25	25	19	19	10	20	19	68	60	67	67	57
1832	25	22	22	17	14	8	23	13	68	61	72	68	62
1932	27	21	16	18	14	12	22	16	68	61	88	71	67
2032	22	21	15	18	14	14	22	16	67	68	89	72	68
2132	22	20	19	18	16	13	22	19	68	65	91	73	"
2232	21	20	16	18	19	14	22	19	67	70	90	74	63
2332	20	20	14	18	17	13	21	19	68	71	92	72	68
0032	21	19	19	17	17	14	22	19	68	71	92	72	"

21-7-82	RM EA	RET AIR	WTSURF	MIST	WTOFF	WTON	LEV AIR	MET	LEV AIR	RET AIR	WTSURF	RM FA	DAMPER	
0132	23	21	19	19	18	19	22	17	67	65	94	71	68	
0232	22	20	19	19	18	15	22	16	68	75	94	74	61	
0332	21	21	19	18	18	14	22	15	62	70	94	70	63	
0432	22	20	15	19	17	14	22	16	67	67	94	74	68	
0532	22	20	19	19	18	15	21	19	67	68	94	74	"	
0632	22	20	19	19	18	15	21	16	69	69	94	75	"	
0732	22	20	19	23	19	19	23	16	67	76	95	73	62	
0832	27	21	19	20	23	15	27	19	64	70	94	68	66	
0932	24	22	19	20	20	19	24	18	68	65	96	70	67	
1032	26	23	24	18	15	9	20	15	69	64	80	68	62	
1132	24.5 27	24 25	22.5 25	18	12 14	9 8	16 21	* 14	70 66	49 63	52 72	47 63	61	
1232	29	26	26	18	14	9	21	14	68	63	74	64	"	
1332	28	26	26	18	13	15	20	14	73	64	74	70	"	
1432	28	26	25	18	13	12	21	14	69	72	73	68	57	
1532	29	27	26	19	14	13	22	19	73	61	74	68	61	
1632	30	26	27	23	19	13	22	19	66	59	70	62	"	
1732	28	26	26	23	19	10	22	19	68	65	68	67	56	
1832	27	23	24	18	14	9	20	14	75	60	75	71	62	
1932	25	23	27	16	13	8	18	13	73	69	74	74	56	
2032	24	20	22	16	12	11	18	12	77	64	77	73	62	
2132	27	21	19	18	15	15	23	16	68	73	92	72	64	
2232	23	21	15	18	19	15	22	15	66	76	92	74	61	
2332	23	22	19	19	17	14	23	16	71	69	94	76	68	
0032	22	21	19	23	19	15	22	16	75	70	94	77	67	
22-7-82 0132	22	21	15	18	18	15	22	19	74	75	94	80	"	
0232	22	21	15	18	17	15	22	16	74	81	94	79	61	
0332	21	20	14	19	18	14	21	19	73	76	95	76	68	
0432	22	20	15	18	18	14	22	15	74	75	94	79	"	
0532	22	20	15	19	18	14	21	16	72	81	94	78	61	
0632	22	19	19	19	18	14	22	19	71	76	95	75	67	
0732	24	22	19	20	18	19	23	19	67	68	97	73	68	
0832	26	24	23	17	15	10	19	14	72	70	84	73	62	
0932	28	24	24	18	15	9	20	14	70	73	75	68	57	
1032	29	26	25	18	14	9	20	15	71	63	76	66	61	
1132	26 29	25 25	21	17	11 12	8 11	15.5 21	13	75 71	45 59	73	46 66	"	
1232	29	31	27	19	13	12	21	15	71	72	74	69	57	
1332	30	27	27	23	14	13	22	19	73	62	73	69	61	
1432	35	27	28	20	15	14	27	15	66	57	64	62	"	
1532	29	27	27	20	19	10	23	16	72	63	76	68	"	
1632	29	26	26	19	19	10	22	16	78	64	83	75	"	
1732	28	26	25	18	14	9	21	19	71	66	76	68	"	
1832	27	24	25	18	13	8	20	14	70	69	72	68	56	
1932	26	23	24	17	12	12	19	13	77	71	81	74	61	
2032	25	27	27	19	13	12	19	13	77	81	82	77	59	
2132	24	21	22	19	13	12	20	14	79	84	80	79	57	
2232	24	22	21	17	14	13	23	14	80	75	84	78	62	
2332	23	22	23	17	14	13	20	14	82	85	82	82	56	
0032	24	22	22	17	15	9	23	14	75	83	81	79	52	

19-2-82	RA FA	RET AIR	WTSORA	MAT	INTCFF	WTCN	LEU AIR	MAT	LEV AIR	RET AIR	WTSUF	RA FA	DOWNDR	
0130	21	20	16	18	19	14	21	16	73	80	93	77	62	
0230	21	19	16	18	17	14	21	16	73	80	94	78	63	
0330	21	19	19	18	17	14	21	15	76	73	95	78	68	
0430	20	23	16	18	17	13	21	19	74	71	94	77	"	
0530	20	19	19	17	17	14	20	19	74	69	93	77	"	
0630	19	23	16	17	17	14	20	15	71	78	91	76	60	
0730	23	21	19	19	18	19	21	19	72	68	96	74	68	
0830	24	22	16	21	19	19	24	18	64	76	94	73	60	
0930	25	24	24	19	15	11	20	14	72	70	75	72	57	
1030	28 26	25 25	26	19	15 12	10 9	21 16	15	69 70	58 45	70	65 40	61	
1130	29	26	26	18	14	9	22	15	66	61	66	65	59	
1230	30	31	27	19	13	9	21	15	66	65	66	65	55	
1330	35	28	28	19	13	9	22	15	61	46	61	56	60	
1430	35	29	29	23	13	8	22	19	56	48	56	51	56	
1530	33	35	30	20	13	12	22	16	54	38	50	49	57	
1630	33	30	30	20	13	13	23	16	55	37	52	48	61	
1730	35	28	29	20	14	13	23	16	57	40	58	57	"	
1830	30	31	31	20	19	11	22	17	58	53	60	56	59	
1930	28	25	26	19	14	10	21	15	64	49	65	60	61	
2030	27	25	26	18	14	8	20	15	60	50	63	55	"	
2130	28	24	26	18	14	8	20	13	59	43	60	54	"	
2230	28	25	26	17	13	11	20	14	55	43	53	54	"	
2330	26	25	26	18	13	12	21	14	54	39	54	50	"	
0030	27	25	26	18	14	13	21	19	54	37	53	49	"	
20-2-82 0130	27	25	26	18	15	13	21	19	53	37	51	50	"	
0230	29	25	26	23	19	9	22	19	49	46	47	48	52	
0330	29	25	27	19	15	10	21	19	52	39	48	49	61	
0430	28	25	25	18	14	9	20	14	60	48	57	55	"	
0530	27	25	25	18	13	8	20	13	59	53	56	57	57	
0630	27	25	26	19	12	11	20	14	59	53	61	54	62	
0730	27	25	25	18	13	12	20	14	67	71	70	63	61	
0830	27	25	24	18	15	12	21	15	80	88	81	81	55	
0930	24	23	23	18	19	9	19	15	83	81	87	82	62	
1030	26 22	27 22	23	18	14 12	10 9	19 15	14	79 85	82 85	80	80 68	55	
1132	25	24	24	17	14	9	19	14	78	76	84	76	62	
1232	25	24	24	18	13	8	19	14	76	77	81	74	61	
1332	27	25	24	18	12	12	20	14	78	79	78	77	56	
1432	27	24	25	18	13	13	20	14	77	73	77	76	61	
1532	25	24	24	18	14	13	20	15	78	76	78	78	57	
1632	26	24	24	19	19	14	20	15	77	81	78	77	56	
1732	26	23	24	19	19	9	20	14	78	71	81	76	61	
1832	25	23	24	16	13	9	19	14	76	80	78	76	56	
1932	24	21	22	17	13	8	19	13	79	79	79	79	57	
2032	24	22	21	19	11	11	18	13	80	74	80	79	62	
2132	23	22	16	19	14	15	23	17	74	78	91	78	60	
2232	27	21	15	19	16	14	23	17	70	75	94	74	66	
2332	23	21	19	19	17	15	23	16	62	76	93	75	61	COPY
0032	22	21	15	19	17	14	22	17	68	69	92	74	67	7

17-2-82	RA FA	REF AIR	WT SOAK	MRT	WT CRF	WT ON	LEV AIR	MRT	LEV AIR	EAT AIR	WT SOAK	RA FA	DRAPER
0130	22	21	19	18	17	14	22	16	67	67	93	70	65
0230	21	20	19	18	17	14	21	19	73	69	92	76	"
0330	20	19	19	18	17	13	21	19	65	71	92	72	"
0430	21	19	15	18	16	13	20	19	72	72	91	78	"
0530	20	23	26	18	17	13	20	15	72	67	92	74	"
0630	21	19	15	18	17	13	21	19	69	74	91	74	63
0730	22	22	16	18	18	15	22	17	69	68	90	74	65
0830	24	27	19	20	23	19	24	17	69	64	92	71	67
0930	25	27	16	21	21	20	25	18	66	71	92	73	60
1030	25	23	24	18	14	11	20	14	73	62	76	69	61
1130	27	25	24	17	13	11	20	14	71	65	77	68	"
1230	27	25	25	17	12	10	20	14	74	64	75	70	"
1330	28	24	24	19	11	11	19	13	73	69	76	73	"
1430	26	25	24	17	12	12	20	14	75	74	81	73	"
1530	31	25	25	17	14	13	20	15	75	65	79	72	"
1630	28	25	25	19	14	14	21	15	72	73	75	73	56
1730	31	24	25	19	15	14	22	15	72	65	73	73	60
1830	26	23	24	18	14	10	20	15	68	67	74	69	59
1930	23	27	23	17	12	9	19	13	72	70	72	73	57
2030	23	21	22	19	11	11	17	12	78	69	90	75	62
2130	23	22	19	18	14	14	24	17	72	77	92	76	67
2230	24	22	15	19	19	15	24	16	70	78	92	76	61
2330	23	21	15	19	17	14	23	16	69	70	93	71	67
0030	22	20	19	18	16	14	22	19	72	70	92	77	68
18-2-82 0130	21	20	19	18	17	13	20	19	71	73	94	75	"
0230	20	20	15	18	17	13	21	19	70	72	94	73	67
0330	20	19	15	17	19	14	21	17	74	68	94	76	68
0430	22	21	19	19	17	19	21	16	70	79	92	75	61
0530	22	20	19	19	18	14	22	16	73	73	94	75	68
0630	22	20	15	19	18	15	21	16	77	87	94	82	61
0730	22	20	19	18	19	15	22	16	75	75	95	77	68
0830	22	21	19	19	19	19	23	17	74	75	95	77	67
0930	22	20	15	19	18	19	21	16	79	84	92	84	60
1030	23	22	19	19	20	18	23	17	78	89	93	83	61
1130	24	23	19	20	21	20	24	18	76	72	95	79	67
1230	26	23	24	17	14	10	20	14	76	66	81	72	61
1330	26	24	24	17	13	10	20	14	68	63	77	68	"
1430	27	24	25	19	13	9	23	14	73	59	74	69	"
1530	28	26	26	17	12	11	20	14	69	56	73	64	"
1630	27	25	25	17	14	12	20	19	73	58	74	69	"
1730	28	25	25	18	14	13	21	14	71	66	76	68	"
1830	25	24	25	17	14	14	20	19	78	68	78	76	62
1930	24	22	22	18	14	15	23	14	78	75	78	79	60
2030	27	21	17	19	19	13	23	16	72	81	90	78	63
2130	23	21	16	23	19	19	22	16	73	80	92	78	61
2230	22	21	19	19	16	15	23	16	71	70	92	75	68
2330	22	20	19	19	17	15	22	19	71	76	93	76	65
0030	22	20	15	18	17	14	22	16	72	80	92	77	62

15-2-82	RA EA	RET DIA	WT SURF	MET	WET OFF	WET ON	LEV AIR	MET	LEV AIR	RET AIR	WT SURF	RA FA	DRY BULB	
0130	32	27	28	23	15	9	22	14	68	68	67	66	54	
0230	35	29	28	23	15	9	22	15	69	71	69	67	55	
0350	31	29	28	19	15	9	23	19	75	68	75	71	61	
0430	30	28	27	18	15	9	22	14	79	80	79	79	60	
0530	28	27	26	18	13	12	20	14	85	79	86	83	61	
0630	28	26	25	18	14	12	21	14	81	87	83	82	55	
0730	28	26	26	19	16	13	21	15	84	81	84	84	61	
0830	30	27	27	20	19	12	22	19	82	79	82	81	"	
→ 0930	31	27	28	20	19	12	27	16	77	75	77	77	"	AND
	27.5	26.5	25		13	11	22.5		61	55		50		
1030	30	27	28	19	17	10	22	19	74	79	77	73	56	
1130	30	28	27	19	19	11	22	15	76	81	81	76	58	
1230	29	26	27	23	15	12	22	19	87	87	58	57	61	
1330	28	26	26	19	15	11	21	19	90	56	91	88	"	
1430	28	25	26	19	15	10	21	15	86	90	92	86	"	
1530	29	31	27	18	15	10	22	19	87	88	92	86	"	
1630	29	26	26	19	14	9	21	15	95	80	59	83	"	
1730	26	25	24	17	14	8	20	14	87	80	88	85	"	
1830	26	25	24	17	13	9	20	13	82	82	99	85	"	
1930	26	25	23	17	13	12	19	13	84	92	87	88	56	
2030	26	26	24	18	14	13	20	14	84	81	89	82	62	
2130	26	24	24	18	14	13	20	15	80	82	81	82	57	
2230	25	23	23	18	15	10	20	15	77	80	82	78	59	
2330	25	27	23	17	14	10	20	14	80	73	82	78	62	
0030	25	23	23	19	13	9	19	13	77	84	81	79	56	
16-2-82 0130	25	23	21	16	12	8	18	13	80	82	81	81	55	
0230	23	22	22	15	12	11	18	13	79	76	84	78	62	
0330	23	22	21	16	13	12	18	13	81	76	82	80	"	
0430	27	22	15	19	15	15	23	17	75	74	90	79	67	
0530	23	21	16	18	16	15	23	16	70	77	92	76	63	
0630	22	21	16	19	16	15	23	16	66	73	91	72	62	
0730	24	22	19	19	18	15	24	18	67	60	93	70	67	
0830	24	23	15	20	19	16	25	17	61	69	91	68	59	
0930	26	24	23	18	13	9	20	14	66	61	71	62	61	
1030	31	25	25	18	13	8	20	14	71	58	70	67	"	
1130	28	25	25	16	12	8	20	13	65	65	69	64	57	
1230	28	26	25	18	12	11	20	14	68	59	74	66	61	
1330	28	25	26	18	13	12	21	15	67	61	73	64	"	
1430	28	26	26	23	14	13	21	19	68	60	71	64	"	
1530	30	27	28	23	15	14	23	19	68	62	70	65	58	
1630	29	31	27	20	14	9	22	15	64	61	63	62	55	
1730	29	27	27	19	14	10	21	19	64	60	62	62	56	
1830	27	25	25	18	13	9	21	14	66	58	68	62	61	
1930	25	27	27	19	11	10	18	13	70	67	74	67	"	
2030	23	22	23	16	12	11	18	13	71	59	73	68	62	
2130	23	27	17	23	15	14	27	16	62	67	88	68	66	
2230	23	21	16	18	19	14	27	17	62	60	90	66	67	
2330	23	22	16	18	15	14	22	16	62	62	92	67	68	
0030	27	21	16	19	17	14	26	16	65	71	95	71	60	

9-2-82	WATER	RET AIR	WETBULB	MAT	WT COFF	WTCN	LAU AIR	MAT	LAU AIR	RET AIR	WETBULB	WATER	DEWPOINT	
0126	25	25	24	18	15	11	20	14	23	22	22	22	61	
0226	25	24	23	17	13	10	19	14	25	27	27	25	57	
0326	24	23	23	17	13	8	19	13	25	25	29	25	59	
0426	24	23	22	16	12	11	18	13	28	26	27	27	56	
0526	27	22	22	19	12	12	18	12	25	26	26	25	57	
0626	23	23	16	18	15	14	23	16	21	26	92	26	63	
0726	25	24	20	19	15	12	21	19	68	63	92	70	62	
0826	27	25	24	19	14	10	20	14	23	65	23	21	61	
0926	28	31	26	18	15	10	19	14	20	66	26	66	"	
	26	26			12.5	12	16		25	49		57		
1026	29	27	26	18	14	13	21	14	22	60	22	67	"	
1126	31	29	28	19	14	13	22	19	20	67	20	68	56	
1226	31	29	28	20	15	15	23	17	21	58	23	67	61	
1326	35	28	28	20	19	12	27	17	21	62	21	20	60	
1426	35	29	29	20	19	12	27	17	67	64	66	65	55	
1526	35	29	28	20	19	10	23	16	65	62	67	62	59	
1626	31	29	28	19	14	10	22	16	65	57	68	60	60	
1726	28	31	26	19	14	9	21	15	67	66	68	65	56	
1826	28	26	25	18	13	11	20	14	69	61	72	64	61	
1926	25	23	27	19	12	12	23	13	20	20	20	20	56	
2026	24	24	23	19	13	13	19	14	20	22	21	20	"	
2126	24	23	23	19	13	13	19	13	23	24	24	23	"	
2226	25	22	23	17	14	14	23	14	25	68	25	26	62	
2326	24	23	22	17	14	9	19	14	22	21	26	21	60	
0026	23	22	22	16	13	8	18	13	22	63	26	20	62	
10-2-82														
0126	23	21	22	15	12	11	18	12	21	23	23	20	57	
0226	23	22	19	17	19	14	23	17	62	63	90	67	67	
0326	24	22	15	19	16	14	27	16	60	69	88	67	60	
0426	24	22	18	19	17	15	24	17	59	63	89	63	64	
0526	23	22	16	23	18	19	24	16	56	63	88	63	62	
0626	24	22	19	19	18	14	24	19	56	57	89	60	67	
0726	25	24	23	17	14	9	20	13	60	62	66	60	56	
0826	28	25	25	18	13	9	20	14	64	62	64	62	55	
0926	30	31	27	18	13	9	21	14	61	63	63	59	56	
1026	30	29	28	23	13	12	22	15	64	61	62	61	55	
1126	33	30	30	21	19	13	24	17	59	50	63	54	60	
1226	34	31	31	21	19	14	24	17	57	54	56	54	55	
1326	35	35	35	22	18	12	25	18	59	56	61	54	60	
1426	35	35	35	22	17	10	25	18	60	52	64	53	59	
	32	31			13	11	19		65	41		41		
1526	35	32	32	22	17	10	25	18	56	51	54	51	55	
1627	35	31	35	21	17	11	24	17	65	48	63	59	59	
1727	34	31	31	20	19	10	24	17	64	51	65	57	60	
1827	35	29	29	20	19	9	22	16	72	57	70	65	"	
1927	29	31	27	19	15	8	22	14	71	71	75	68	61	
2027	28	26	26	18	13	10	20	14	76	66	77	73	"	
2127	26	25	25	18	13	12	19	14	77	72	77	76	"	
2227	26	24	24	18	14	12	20	14	76	70	80	73	62	
2327	26	25	24	19	15	13	20	14	72	73	76	71	59	
0027	26	24	24	18	16	10	20	15	75	66	74	73	62	

5-2-82	RQ FLR	REF AIR	WT SURF	MET	WT DIFF	WT CW	LEV AIR	MET	LEV AIR	REF AIR	WT SURF	RQ/FLR	DAMPER	
0125	24	22	22	17	13	8	18	13	72	61	73	70	62	
0225	24	21	22	16	13	12	18	13	73	60	73	69	"	
0325	24	22	17	19	15	14	23	17	64	65	86	70	61	
0425	24	22	17	18	15	15	27	17	64	59	88	67	67	
0525	23	22	17	23	19	19	27	16	63	56	85	62	"	
0625	24	21	16	19	17	19	23	16	59	62	84	65	60	
0725	25	27	19	20	19	16	25	18	57	56	89	61	67	
0825	27	25	25	17	15	9	20	14	66	61	66	65	58	
0925	29	27	27	18	15	9	21	19	63	57	67	59	61	
0950	26	25.5			11.5	11	15.5		65	42		40		
1025	31	28	28	18	14	11	21	17	62	56	60	58	56	
1125	35	29	29	20	19	13	27	16	58	48	54	54	59	
1225	34	30	31	21	16	14	24	17	52	30	48	45	60	
1325	35	35	35	22	18	12	24	18	44	31	43	39	"	
1424	35	35	35	22	18	12	25	18	44	29	38	39	55	
1524	37	33	32	22	18	11	25	18	40	32	35	35	56	
1624	37	34	33	21	19	15	26	18	40	20	37	32	59	
1724	37	33	33	21	16	9	25	18	42	18	36	37	60	
1825	34	31	31	21	16	10	24	19	42	17	37	35	"	
1925	35	28	28	18	15	9	22	19	67	29	49	44	"	
2025	29	27	31	18	13	12	21	14	49	36	47	44	"	
2125	29	26	26	18	14	13	21	19	57	38	46	48	61	
2225	28	26	26	23	15	13	22	19	48	28	47	43	"	
2325	28	26	26	19	19	14	22	19	46	36	41	44	57	
0025	28	26	31	19	19	11	22	19	42	26	41	37	62	
6-2-82														
0125	29	26	27	18	19	10	21	15	37	20	36	33	61	
0225	29	25	27	18	14	9	21	14	35	16	30	31	"	
0325	28	26	26	18	13	12	20	15	38	19	33	33	"	
0425	28	25	26	19	14	13	21	14	33	20	32	30	"	
0525	28	25	26	18	14	13	20	19	37	17	32	33	"	
0625	28	25	26	18	15	13	21	19	38	28	33	37	60	
0725	30	27	28	20	17	10	22	16	37	26	36	33	61	
0825	35	28	29	19	15	11	23	16	40	29	37	34	60	
0925	35	30	30	20	17	11	24	16	42	25	37	36	"	
1025	35	35	32	21	16	10	25	17	36	19	28	31	59	
1100	32.5	30.5			14	11	18		49	25		21		
1125	37	34	35	21	17	12	25	18	27	9	22	26	54	
1225	38	34	34	22	17	12	26	19	21	10	17	21	53	
1325	40	37	39	23	17	12	26	18	19	6	14	19	58	
1425	41	36	39	27	17	12	31	23	16	2	12	16	54	
1525	40	37	35	23	17	12	31	19	7	0	9	12	55	
1625	39	35	35	22	17	11	26	18	20	9	16	19	"	
1725	37	35	35	21	16	11	25	18	41	20	34	34	59	
1825	36	34	34	21	19	12	25	17	42	16	36	37	"	
1925	33	31	30	21	19	11	23	19	53	48	50	50	55	
2025	35	30	29	23	14	9	22	19	54	35	49	51	60	
2125	31	29	28	19	13	12	22	15	53	35	47	50	61	
2225	31	28	28	23	14	13	22	16	47	34	42	45	56	
2325	30	28	28	19	19	14	22	15	48	29	46	43	61	
0025	30	27	28	19	19	15	22	15	52	34	51	48	62	

2-82	RA FA	REF AIR	WT SURF	MIST	WT OFF	WTCN	LIEV AIR	MIST	LEV AIR	REF AIR	WT SURF	RA FA	DANGER	
0120	21	20	16	19	17	19	21	16	23	70	91	72	68	
0220	21	20	16	18	19	13	91	19	72	73	93	74	"	
0320	21	20	15	18	17	14	70	19	75	72	93	78	"	
0420	21	23	15	18	17	14	21	19	73	68	93	76	"	
0520	20	18	16	18	16	13	20	15	73	70	94	76	"	
0620	19	13	16	18	16	13	20	14	70	77	91	76	62	
0720	22	20	19	18	18	14	21	19	72	70	93	77	68	
0820	23	22	16	20	18	19	23	17	65	63	94	70	62	
0920	25	22	23	18	15	11	20	14	69	63	77	69	60	
1020	27	24	24	19	14	9	20	14	66	63	67	66	55	
1120	25 27	25 25	26	18	11.5 14	9 9	15 19	15	75 67	45 60	66	45 65	55	
1220	29	27	25	15	14	10	20	14	68	60	71	63	61	
1320	30	27	27	18	13	12	21	14	69	52	67	63	"	
1420	30	28	26	19	19	13	22	15	67	56	69	60	"	
1520	30	27	28	19	19	14	21	19	67	55	67	60	"	
1620	29	26	27	19	19	14	22	15	70	58	68	67	"	
1720	29	25	27	19	16	15	21	19	71	57	69	67	"	
1820	26	25	25	18	15	9	20	14	71	68	74	69	"	
1920	24	23	23	16	13	9	18	13	79	78	79	78	57	
2020	23	22	21	19	12	12	18	13	79	78	79	79	"	
2120	22	22	16	19	19	19	27	16	76	70	84	79	67	
2220	23	22	19	19	19	15	22	16	76	72	96	78	68	
2320	22	22	15	23	16	14	23	17	76	77	95	81	67	
0020	27	21	19	23	17	14	22	17	74	70	97	77	68	
2-82 0123	23	21	18	18	18	19	22	16	73	79	95	77	63	
0223	23	21	19	19	18	15	22	17	76	70	97	77	68	
0323	21	21	19	23	18	14	23	16	75	74	96	80	"	
0423	22	20	19	19	15	13 22	22	17	72	70	97	75	"	
0523	23	20	15	19	18	15	22	16	65	77	97	76	64	
0623	22	20	19	20	19	14	22	19	66	75	97	74	65	
0723	24	22	16	20	19	19	24	17	69	68	95	74	68	
0823	26	24	19	21	19	19	25	18	67	66	95	72	67	
0923	31 25.5	24 24	25	18	19 14	10 10	20 15.5	14	72 76	60 45	72	69 42	61	
1023	30	28	27	18	15	10	21	15	66	62	69	62	"	
1123	31	28	28	17	14	9	21	14	68	62	65	63	56	
1223	31	29	28	18	15	9	21	19	71	58	70	64	61	
1323	32	29	27	19	14	12	22	19	67	64	68	63	57	
1423	32	30	29	20	15	13	27	16	68	61	65	64	56	
1523	34	30	31	21	19	19	24	17	64	48	61	57	60	
1623	33	29	30	21	17	11	24	19	65	62	64	61	57	
1723	31	29	29	19	17	12	23	17	67	57	63	63	60	
1823	30	27	28	19	19	10	22	19	70	56	69	64	61	
1923	27	25	25	18	13	9	20	15	78	67	77	73	"	
2023	26	24	23	17	12	11	19	13	76	68	75	75	"	
2123	26	23	24	17	13	12	23	13	73	75	74	72	57	
2223	25	23	24	19	14	13	20	14	76	72	74	75	"	
2323	25	22	24	17	14	14	19	14	76	67	74	74	62	
0023	25	23	23	17	15	14	19	14	77	67	76	73	"	

30-1-82	CO FA	REF AIR	WT SURF	MET	WT OFF	WT ON	LEV AIR	MET	LEV AIR	RET WCR	WT SURF	RE FA	DANGER	
0120	24	22	22	19	12	12	18	13	80	78	84	77	62	
0220	27	22	21	16	13	12	18	13	81	88	84	82	58	
0320	27	22	16	23	19	19	22	16	79	85	95	84	62	
0420	22	22	16	23	17	19	27	17	78	86	96	82	"	
0520	23	22	15	20	17	19	23	16	78	86	96	82	"	
0620	27	21	19	20	18	19	23	19	78	79	96	84	67	
0720	24	22	16	20	19	16	23	18	74	77	97	77	"	
0820	26	27	27	18	15	10	20	14	75	68	78	74	59	
0920	26	24	24	18	14	9	19	14	72	71	77	71	58	
1020	26	24	24	17	14	9	23	13	70	70	74	70	57	
1120	26	23.5	24	17	13	11	19	13	65	65	68	65	"	
1220	27	25	25	17	13	12	20	14	71	61	70	69	61	
1320	28	25	26	18	14	13	21	15	70	55	68	65	"	
1420	28	26	26	19	19	14	21	19	72	56	70	67	"	
1520	28	26	26	23	19	11	22	19	69	63	72	65	"	
1620	29	25	26	19	19	10	21	19	71	68	69	69	56	
1720	27	25	25	18	14	9	20	14	76	63	75	71	61	
1820	27	25	25	17	13	8	20	13	74	68	77	70	"	
1920	25	23	24	19	12	11	18	13	81	70	82	78	62	
2020	24	25	22	16	13	13	19	12	76	75	80	75	"	
2120	25	23	24	17	13	12	19	13	79	70	82	76	"	
2220	27	25	24	18	14	13	20	19	76	73	76	76	57	
2320	26	26	25	19	19	10	21	15	78	71	77	77	62	
0020	25	22	27	17	14	9	19	14	80	73	79	79	"	
31-1-82 0120	23	21	22	17	13	8	17	13	77	73	82	76	"	
0220	27	22	21	16	12	11	18	12	77	78	81	76	61	
0320	23	21	22	19	12	12	18	13	79	84	80	79	57	
0420	27	21	21	16	13	12	18	13	80	78	84	78	62	
0520	23	21	16	19	19	14	27	16	75	83	92	79	"	
0620	23	21	17	19	16	19	27	19	77	73	95	79	65	
0720	24	22	16	23	18	19	23	17	76	71	96	79	67	
0820	24	27	17	21	19	19	25	17	72	79	94	78	61	
0920	25	23	23	17	14	10	19	14	76	79	81	76	57	
1020	26	23.5 23	23	19	13	12 10	19	14	80 76	81 76	77	51 76	56	
1120	27	25	24	19	13	9	20	13	71	73	74	72	"	
1220	27	26	26	18	12	12	21	13	72	58	74	67	61	
1320	27	26	26	17	14	12	21	15	71	55	71	66	"	
1420	28	26	26	18	15	13	21	19	71	58	72	66	"	
1520	30	31	27	20	19	14	22	19	71	66	73	69	58	
1620	29	27	27	19	19	11	22	15	71	65	72	70	56	
1720	27	25	25	18	15	9	20	15	74	70	73	73	"	
1820	26	24	24	18	14	9	20	14	74	62	74	71	61	
1920	25	22	22	16	12	10	18	13	73	71	73	73	56	
2020	27	21	22	16	13	11	18	12	72	75	76	73	59	
2120	27	21	17	18	15	13	23	16	71	64	88	73	68	
2220	23	21	16	19	17	15	23	16	69	77	90	74	61	
2320	22	21	15	19	16	16	22	16	70	75	92	75	64	
0020	22	21	19	18	15	14	22	19	70	71	93	73	68	COPY 5

1-82	RA/FA	RET AIR	WT SURF	MAT	WT COFF	WT CC	LEV AIR	MAT	LEV AIR	RET AIR	WT SURF	RA/FA	DAMPER
C120	23	21	17	19	19	12	22	18	67	74	89	72	64
0220	22	21	18	20	17	16	22	19	65	65	89	70	68
0320	23	21	17	19	18	19	22	17	67	74	86	72	62
0420	23	21	16	21	18	19	22	17	65	71	85	71	61
0520	22	20	18	18	17	19	21	19	68	66	88	74	65
0620	22	21	17	18	18	15	22	16	70	77	87	74	63
0720	24	23	18	21	19	16	24	18	66	72	88	70	62
0820	27	24	25	19	19	10	21	15	64	61	68	63	61
0920	29	26	26	19	19	10	21	19	63	57	65	58	"
1020	26 30	25 26	27	19	12 15	9 10	16 22	19	62 57	39 52	38 56	54	56
1120	32	28	29	19	19	10	22	19	57	38	55	51	60
1220	34	30	30	19	15	10	26	16	53	41	47	47	"
1320	35	35	29	23	15	10	22	19	60	45	48	44	58
1420	34	30	30	19	14	10	27	19	50	36	44	45	60
1520	33	35	31	19	14	12	23	19	48	34	44	43	57
1620	34	31	31	19	19	13	24	17	50	47	47	46	"
1720	34	35	31	21	16	14	24	17	53	40	52	47	60
1820	32	29	30	21	17	12	23	19	60	44	56	54	61
1920	30	27	27	19	15	15	22	16	73	71	70	71	56
2020	27	26	26	18	13	10	20	14	71	65	74	67	61
2120	28	25	25	17	13	9	19	14	76	68	78	72	"
2220	26	25	24	17	12	12	23	13	77	68	79	74	62
2320	26	24	24	17	14	12	19	14	74	76	77	73	57
0020	25	23	24	19	14	13	20	14	80	73	77	78	62
19-1-82 0120	25	22	23	18	14	13	23	14	77	75	80	74	"
0220	23	22	22	17	14	13	23	14	79	76	81	76	"
0320	24	22	23	19	14	10	19	14	79	71	78	78	"
0420	24	22	21	16	13	8	18	13	76	78	78	76	58
0520	23	21	20	19	12	11	21	15	76	79	79	79	61
0620	27	22	15	18	15	13	23	16	73	74	94	75	67
0720	25	24	24	17	14	9	19	13	75	72	80	72	62
0820	27	24	24	19	12	11	20	14	71	71	76	69	61
0920	27	25	26	18	14	13	20	15	75 80	65 49	73 66	72	"
940	26	25.5	31	23	14	13	22	16	78	64	78	74	"
1020	29	27	30	20	19	14	22	17	78	76	77	77	56
1120	30	27	27	19	17	12	22	16	77	81	78	76	"
1220	30	28	27	20	16	12	22	16	74	74	75	72	57
1320	30	27	28	23	19	12	23	15	70	66	71	67	59
1420	30	27	29	19	15	11	22	19	74	69	72	72	56
1520	30	29	27	19	14	10	22	15	76	72	74	74	58
1620	30	28	31	18	13	10	21	14	78	67	78	73	61
1720	29	31	24	17	13	13	20	14	80	75	84	76	"
1820	28	26	24	18	13	12	19	14	81	80	81	81	57
1920	26	23	24	18	13	13	19	14	84	77	83	81	62
2020	25	24	24	17	15	13	20	15	83	82	83	83	"
2120	25	24	24	19	15	15	19	14	83	73	83	79	"
2220	25	22	23	17	14	9	19	13	80	85	83	80	58
2320	24	22	22	16	13	10	19	13	81	76	84	75	62

26-1-82	SA/FA	RET AIR	WT SURF	MBC	WT OFF	WT CON	LEV AIR	MBC	LAV AIR	RET AIR	WT SERP	RA/FA	DAMPER	
0120	23	22	15	19	14	14	22	19	69	61	91	72	68	closed
0220	22	21	16	19	15	15	22	16	67	72	91	72	61	
320	22	21	15	19	16	14	22	15	65	67	91	22	"	
420	21	20	16	17	16	14	21	19	63	65	91	72	67	
520	21	20	16	18	17	14	21	14	65	66	89	22	66	
620	21	20	16	18	19	14	21	19	62	63	90	67	68	
720	22	21	16	19	18	14	22	16	62	64	94	69	"	
820	24	22	16	20	18	19	24	17	60	53	91	65	67	
920	24	23	19	20	23	16	24	18	61	54	92	65	"	
1020	25	23	17	21	20	19	24	18	63	58	94	68	"	
1160	22.5	22.5			13	10	15.5		70	45		45		
1120	25	24	24	18	15	10	19	14	61	54	66	58	61	
1220	26	25	24	17	14	9	20	14	58	55	62	57	57	
1320	26	25	24	19	13	11	20	14	62	53	66	58	61	
1420	27	25	25	18	13	12	20	14	64	57	63	63	"	
1520	28	24	25	18	14	13	20	15	64	54	63	63	"	
1620	28	25	26	19	19	14	21	14	67	52	65	62	"	
1720	26	24	24	18	15	15	20	15	64	66	65	64	52	
1820	25	22	27	17	15	10	19	14	66	58	71	66	62	
1920	23	22	22	16	13	9	18	13	72	60	73	69	"	
2020	23	22	17	18	14	13	23	19	61	65	82	69	61	
2120	23	21	19	18	15	14	21	16	64	58	88	68	65	
2220	21	20	16	18	16	14	22	19	63	67	85	20	60	
2320	21	20	16	18	16	13	21	19	64	72	86	71	61	
0020	21	19	19	18	19	13	20	19	66	62	87	68	68	
27-1-82														
0120	20	23	19	17	16	12	20	14	68	64	84	71	"	
0220	21	19	19	17	16	13	20	15	70	65	86	72	"	
0320	20	23	16	17	16	13	19	14	67	74	85	73	60	
0420	20	18	19	18	16	14	19	15	70	67	86	73	68	
0520	19	18	15	19	15	13	19	14	65	74	84	71	61	
0620	20	18	15	19	15	13	19	14	67	69	82	72	62	
0720	20	23	16	17	17	14	21	15	63	69	85	68	64	
0820	22	20	16	19	18	19	22	18	59	65	83	68	61	
0920	24	23	16	20	19	19	24	18	60	56	88	65	67	
1020	22.5	22			13	10	15		70	47		45		
1120	26	25	24	17	14	9	19	14	67	60	67	67	62	
1220	26	24	25	17	14	9	19	14	69	58	68	66	61	
1320	28	25	26	18	13	12	20	19	69	52	67	63	"	
1420	29	27	26	18	14	11	21	19	60	50	61	55	"	
1520	30	28	28	20	19	13	22	15	59	50	61	55	"	
1620	30	31	27	20	19	14	23	16	67	66	66	65	57	
1720	31	28	27	19	17	15	22	17	69	59	71	64	60	
1820	35	28	29	19	16	10	22	16	61	45	60	59	"	
1920	29	26	27	18	15	10	21	15	68	57	65	65	61	
2020	26	23	24	16	13	15	18	13	77	63	74	72	"	
2120	24	22	22	16	13	11	18	13	78	68	76	75	62	
2220	21	21	22	16	13	12	18	13	75	66	77	73	"	
2320	23	21	23	17	14	13	18	14	75	70	73	74	61	
2420	23	22	22	17	14	13	19	14	72	71	74	71	62	
0020	27	21	23	19	19	14	22	17	69	74	82	72	63	

C.1.4 Measurement of Air Quantities
Measurement of Water Quantities
Fan Motor Power

AIR QUANTITIES

Air quantities have been measured with the pitotstatic tube in the main ducts and with the anemometer at the registers and the return and the fresh air grilles.

Velocity pressure in the main Supply air duct = 0·09" w.g.

Internal clear dimensions of the duct = 20" × 8"

Internal clear [redacted] area = 20×8/144 = 1·11 sq ft.

Velocity of air in the duct = $3970 \times \sqrt{0{\cdot}09} = 1191$ fpm

Supply air quantity measured at the Supply air duct = 1·11 × 1191 = 1322 cfm = 624 l/s.

Air quantities measured at the Supply air outlets with Cone and anemometer = 576 l/s

Air quantities measured at the return air and the fresh air grilles = 600 l/s

$$\text{Average total air quantity} = \frac{576 + 624 + 600}{3}$$

$$= \frac{1800}{3} = 600 \text{ l/s}$$

FAN MOTOR POWER

Actual wattage drawn by fan motor = 462 Watts

WATER QUANTITIES

Water quantities have been measured by "DOBBIE DICO" meters at this stage. Accuracy, as described by the manufacturers ±2%.

Maximum water flow through chiller/exchanger circuit = 0·95 l/s.

Work/Title	Sheet Number
Prepared	Checked

C.2 DARWIN EXPERIMENTAL STATION

C.2.1 Cooling, Dehumidification and Reheat

C.2.2 Cooling and Dehumidification

C.2.1.1 Analysis of Test Data with Psychrometric Charts

AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION , AIR CONDITIONING & HEATING , INC.

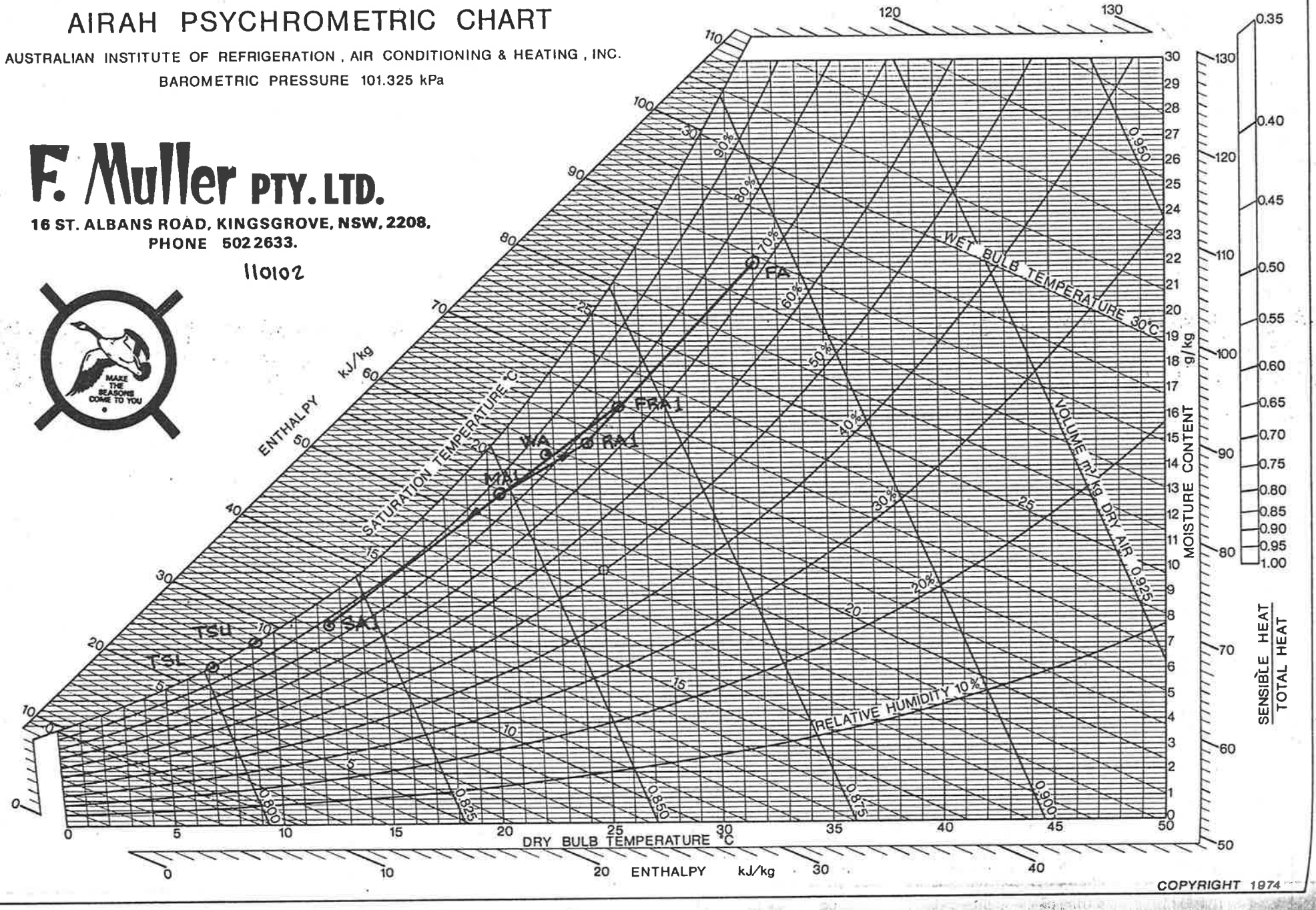
BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

16 ST. ALBANS ROAD, KINGSGROVE, NSW, 2208.

PHONE 502 2633.

110102



AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION , AIR CONDITIONING & HEATING , INC.

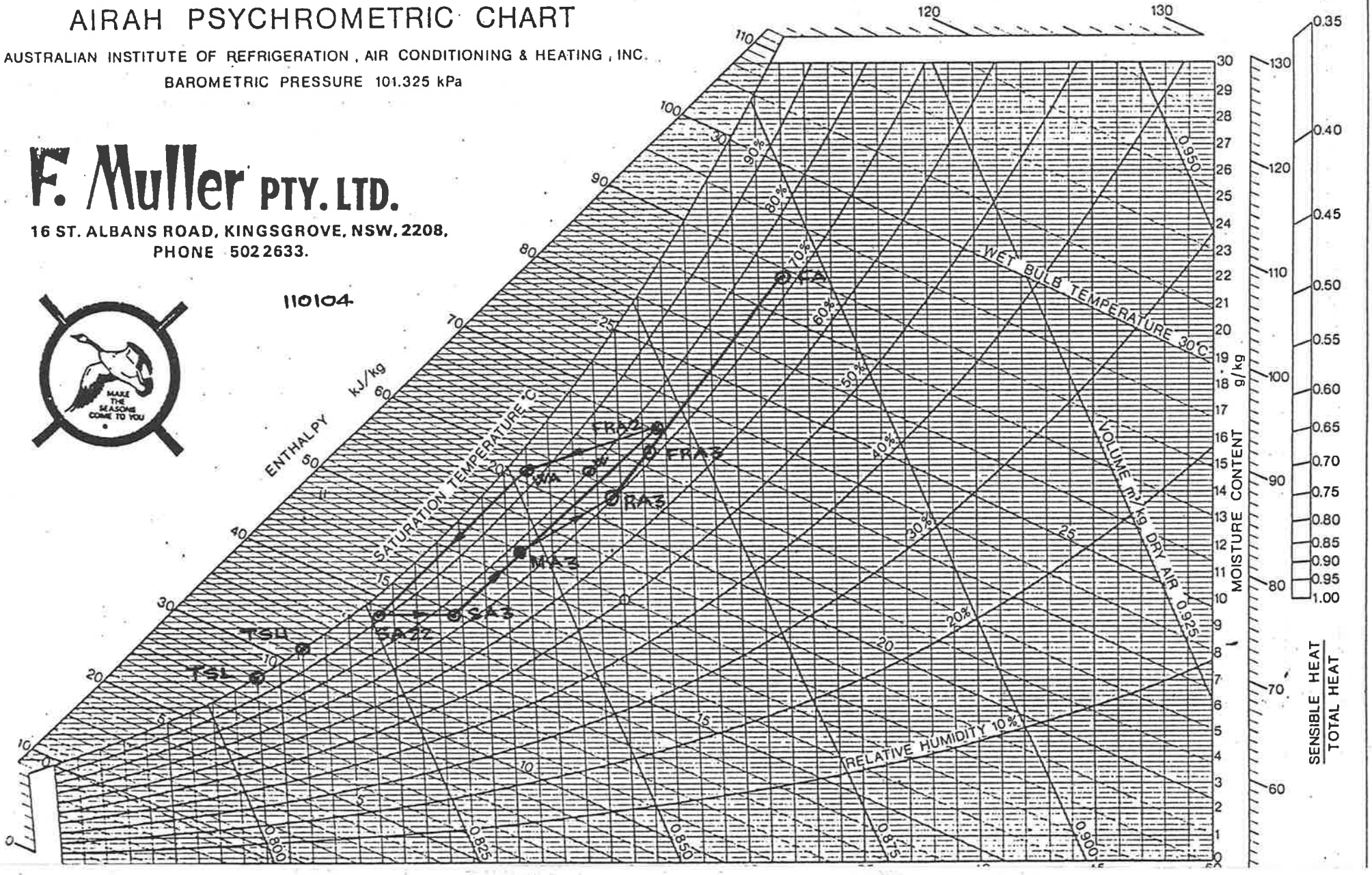
BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

16 ST. ALBANS ROAD, KINGSGROVE, NSW, 2208.

PHONE 502 2633.

110104



AIRAH PSYCHROMETRIC CHART

AUSTRALIAN INSTITUTE OF REFRIGERATION, AIR CONDITIONING & HEATING, INC.

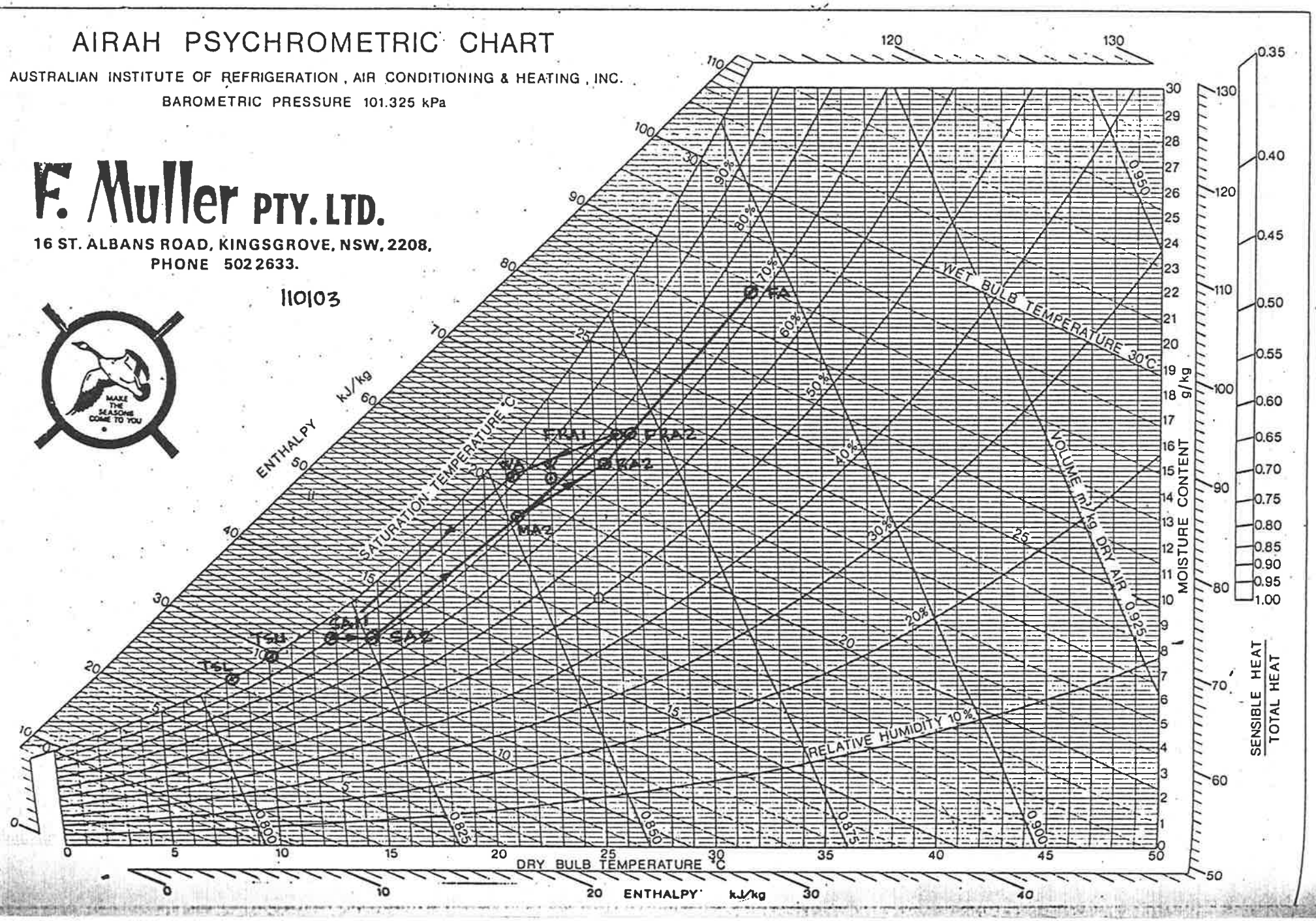
BAROMETRIC PRESSURE 101.325 kPa

F. Muller PTY. LTD.

16 ST. ALBANS ROAD, KINGSGROVE, NSW, 2208.

PHONE 502 2633.

110103



COOLING, DEHUMIDIFICATION & REHEAT

REF	FRESH AIR FA °CDB	FA GM/KGDA	FRESH & RETURN AIR MIXTURE FRA °CDB	FRA GM/KGDA	AIR RETURNED OR ROOM AIR RA °CDB	RA GM/KGDA	RA %RH	AIR LEAVING HORIZONTAL SURFACE WA °CDB	WA GM/KGDA	SUPPLY AIR SA °CDB	SA GM/KGDA	MIXED AIR MA °CDB	MA GM/KGDA	TEMP. UPPER & LOWER LAYERS TSL-TSU °C	°C	THERMAL ENERGY SUPPLIED BY CONVERTER QT WATTS	AIR QTY THRU APPARATUS AQA L/s	TOTAL AIR QTY AQL L/s	BY-PASS FACTOR APPARATUS BF1 DIMENSIONLESS	BY-PASS FACTOR AUTO BF2 DIMENSIONLESS	A/C LOAD L WATTS	LOSS FROM APPARATUS qa WATTS	REHEAT RHT WATTS
110103	32	22	26	16.4	24.5	15	78	22.8	14.6	12.4	7.9	20.6	13	7·2–9·2 / 8·2–10·2		7959	240	600	0·23	0·60	10037	380	–
110103	32	22	26.8	16.4	25.5	15.1	73	21.3	14.7	14.6	8.4	21.5	13.2	9·0–11·0		7959	240	600	0·23	0·60	9561	380	518
110104	32	22	26.2	15.4	24.8	13.8	70	21.0	14.8	17.8	9.4	20.8	11.7	12.0–14.0		7959	405	600	0·32	0·33	14629	632	1750

AT HOUR 110102, REHEAT DAMPER IS OPENED.

ENERGY BALANCE

AT THE BEGINNING OF 110103 HR, FRESH/RETURN AIR FRA1 CONDITIONS 26°CDB, 16.4 $\frac{GM}{KGDA}$. COOLING & DEHUMIDIFICATION FOLLOWS THE LINE FRA1 WA SA11. REHEAT FOLLOWS THE LINE SA11-SA2. AT THE END OF 110103 HR, FRESH/RETURN AIR CONDITIONS SHIFTS TO FRA2. HEAT GIVEN UP BY WARMER INCOMING AIR WWA. HEAT TAKEN UP BY COLDER OUTGOING AIR SA11-SA2.

AT THE BEGINNING OF 110102 HR, FRESH/RETURN AIR FRA2 CONDITIONS 26·3°CDB, 16·4 $\frac{GM}{KGDA}$. COOLING & DEHUMIDIFICATION FOLLOWS THE LINE FRA2 WA SA22. REHEAT FOLLOWS THE LINE SA22 SA3. AT THE END OF 110104 HR, FRESH/RETURN AIR CONDITIONS SHIFTS TO FRA3. HEAT GIVEN UP BY WARMER INCOMING AIR WWA. HEAT TAKEN UP BY COLDER OUTGOING AIR SA22 SA3.

GORMACK GRAPH PAPERS : CHRISTCHURCH N.Z. C101Y 19 cm x 28 cm in mm

C.2.2.1 Recorded Test Data

See separate thermohygrograph.

D. PROJECT INFORMATION, MATHEMATICAL CALCULATIONS, MODELS AND COMPUTER PROGRAMS

D.1 MAGILL HOUSE

D.1.1 Equipment, Building and Other Information

2.A. GENERAL

Magill House Project is experimental. The passive initiatives were somewhat limited by the fact that the Magill House was built in 1918.

The house has a domestic environment with three bedrooms, lounge, dining room, kitchen and toilet.

The occupied areas are:

		SQ. M
Bedroom 1	---	24
Bedroom 2	---	23.5
Bedroom 3	---	17.5
Lounge	---	20
Dining Room	---	19
Kitchen	---	16
Bathroom/Toilet	---	9

The ceiling height for occupied areas, except Kitchen and bathroom/toilet is 3.6 m.

The ceiling height for toilet is 3.0 m.

The Kitchen has inclined ceiling and the average ceiling height is 3.0 m.

2.B. PASSIVE FEATURES

Light coloured double brick walls with a 50 m/m gap,

haded windows,
haded walls on eastern and southern fascia,
me covered areas on northern fascia,
ees and bushes
providing
shades
for
estern fascia and some northern fascia.

C. NON-PASSIVE FEATURES

orrugated iron roof with no insulation,
ent holes on upper levels on interior walls,
lent holes on upper and lower levels on exterior walls,
lented ceiling,
Extreme energy loss and infiltration are the result of
ese non-passive features,
The system performance will definitely improve with
nsulated roof and no infiltration.

2. D. ACTIVE FEATURES (PHASE 1)

GENERAL

This project is to provide a low energy environmental
control system including some passive but total active
energy features.

The system was designed using mostly computer techniques
and some conventional air conditioning technology.

The installation of equipment is as follows:
~~is to be carried out in three phases.~~

1) This active heating and cooling system

Consists of energy storage vessels/exchangers, reverse cycle hermetic refrigeration compressor (with a conventional heat-exchanger to provide hot and cold water and air cooled energy rejection system), pumps, supply air fan, ductwork and pipework. This system is designed to ensure that the indoor comfort-conditions are satisfied with the minimum consumption of conventional fossil fuel energy.

The system includes the following features:

A central air handling unit with supply air fan, energy storage vessels/exchangers and a by-pass air system;

Reverse cycle refrigeration compressor with a heat-exchanger to provide hot and cold water, air cooled heat rejection system, necessary pipework for hot-cold and chilled water circuits and automatic contro

Air distribution system.

2) Solar equipment such as flat-plate solar colle of non-concentric type, solar hot water cylinder necessary pipework and circulating pump.

3) Absorption chiller

In the air treatment process, the mixture of fresh air and return air is supplied with sufficient heating (or coo capacity to offset the instantaneous building load. This achieved through a convenient and constant volume sys by controlling the fresh air/return air temperature and hum

The air is passed over

The exposed water surfaces, and
the metal surfaces
of
the energy storage vessels/exchangers.

The installation has been completed and the energy storage vessels/exchangers have been operating since first week of June, 1981 with the assistance of a reverse cycle hermetic refrigeration Compressor.

MATERIALS

All M.S. Sections are to AS 1131.
All galvanised iron sheets are manufactured by Lysaghts.
All Solders have been applied in accordance with AS H 1

DUCTWORK AND CASING FOR ENERGY STORAGE VESSELS/EXCHANG

Ductwork and casing Material	...	1·2 mm thick galvanised iron sheet.
Insulation	...	Resin bonded mineral wool.
Thickness of Insulation		
Supply air duct	...	50 mm
Return air duct	...	25 mm
Energy storage vessels/exchangers	...	100 mm

Volume control Dampers ... ... Fitted to each

Ceiling Outlets ... --- Four way blow type; designed to mix the incoming air with the room air at high level without exceeding the air velocity level of 0·25 m/s; 600mm x 600 mm; manufactured from extruded aluminium section.

Ceiling mounted return air grille ... --- Lattice core type; having a free area of 85 %; manufactured from extruded aluminium.

Flexible ductwork --- --- installed between the fan housing and the supply and return air ductwork to minimise the transmission of noise and vibration.

Automatic By-Pass Dampers --- To by-pass energy exchanger and its controlled by return air temperature sensors.

PIPEWORK

Material --- Copper to AS 1432 type B.

Max. Service Pressure --- 500 kPa

Insulation --- Not applied

Butterfly Valves --- For isolating and throttling duties.

Control Valves --- For automatic throttling duties and change over duties for Summer and Winter conditions

IPPLY AIR FAN

upply air circulator is a centrifugal fan with forward
rue type impeller.
n motor is suitable for operation on single phase electrical
upply and the motor speed can be adjusted between 500
d 750 R.P.M.

UMPS

umps are centrifugal type and have flow adjustment and
in Venting facilities.
ump motors are suitable for operation on single phase,
0 cycle electrical supply.

EVERSE CYCLE HERMETIC REFRIGERATION COMPRESSOR
ND ASSOCIATED ACCESSORIES

efrigerant	---	R 22
ater Heat Exchanger	---	Shell and coil type
essure Differential, ater Heat Exchanger	---	4 KPa
djustable Flow Rate, ater Heat Exchanger	---	·033 to ·05 L/sec
Compressor, type	---	Hermetic
Compressor, starting method	---	Line start
Compressor Motor, Power Rating	---	2·2 Kw
Heat Rejection Fan, Type	---	Propeller
Air flow	---	70 l/s
Rating	---	0·08 Kw
Refrigerant Flow Controller	---	Capillary tube
Refrigerant oil		SUNISO 4GSD

Refrigerant Volume	1 litre
Refrigerant Weight	3·3 Kg
Cooling Capacity (nominal)	7400 watts
Heating Capacity (nominal)	7100 "

Operating Water Temperature Characteristics

Heating	31°C – 44°C
Cooling	11°C – 25°C
Defrost Controller, Defrost time	11 minutes
on	0°C
off	12·5°C
Crankcase Heater	On when compressor is idle. Protection against Refrigerant being liquidified when Compressor is idle.
Make and Model	NATIONAL BVO3CHY

ENERGY STORAGE VESSELS/EXCHANGERS

Energy storage vessels/exchangers have been manufactured from galvanised iron sheets of 1·2 mm thick

The base of the vessels/exchangers has been supported by timber bearers, fixed to the concrete plinth. A vapour barrier is separating the concrete plinth from the timber bearers. Resin bonded mineral wool has been packed tightly under the base to minimise the energy loss.

The sides of the vessels and the corridors of air tunnels have wide V-shape panels. These panels have been

andardised and, the number of panels, required for any rticular installation, is determined by the load and tonage facility.

he most fossil fuel power consumption occurs in the production rethods and the V panels have been designed and developed n such a manner that there is absolute minimum material wastage and the panels can be made with simple manufacturing techniques.

The vertical sections are joined by riveting and then water proof non-hardening compound has been applied to make each joint air and water-proof.

Horizontal metal strengthening strips have been fitted on top sections of the vessels to provide a predetermined inclination of the vertical surfaces towards the base such that the condensing droplets can run down the surface at a much faster rate. This feature is included to avoid the condensing film growing in thickness and thus avoiding the slower rate of energy transfer.

The panels are soldered with the base and non hardening compound has been applied to make the joints air and water tight.

The casing has been fabricated from Galvanised Iron sheets of 1·2 mm thickness. The resin bonded mineral wool has been packed tightly between the casing and the external separating walls of the air tunnels and air chambers.

Insulated vapour proofed access opening has been provided for each vessel. It is envisaged that the dissolved solids will form layers on interior surfaces of the separating walls.

- A hardening layer on the metal surfaces,
- A dissolved solid layer of higher densities next to the hardening layer.

The accesses are to provide easy maintenance facilities to clean the vessels by manual means.

It is to be noted that, there are no easy methods of cleaning the conventional heating and cooling coils. The methods adapted for coils are based on chemical cleaning procedures and experience has shown that the life span of the coils decreases at a much faster rate due to the chemical interaction.

No. of Vessels	--	2
Each Vessel Water surface area (Adjustable for experimentation)	--	0·5 to 1·25 m^2
Each Vessel metal surface area	--	8·6 to 9·3 m^2
Vessel Capacity	--	1,430 litres
Width of air tunnels	--	150 mm
Height of air passage	--	1500 mm
Air Velocity within tunnels	--	3·0 to 4·5 m/sec.

AUTOMATIC CONTROLS

PHASE 1 EXPERIMENTATION

GENERAL

All electrical motors, Controllers, Control point adjustment mechanisms, time delays, relays, Switches, Contactors, Switchboard and other electrical equipment required for the satisfactory operation of the system have been installed in compliance with the Rules and Regulations of the S.A.A Codes.

All automatic Controls are energised through a MASTER "ON-OFF" Switch.

For capillary tube Sensors, exposed capillaries are armoured in protective tubing.

All electrical circuits have been protected by appropriate fuses.

Temperature Sensors are tamper-proof and pre-calibrated.

Capillaries are ambient compensated.

All humidity Sensors are temperature compensated and have been arranged to provide appropriate feed back.

HERMETIC REFRIGERATION COMPRESSOR AND ASSOCIATED ACCESSORIES

High and low refrigeration pressure Switches

This Switch stops the Compressor when the refrigerant operating pressure is abnormal. A reset button is provided for manual operation.

Defrost Controller and timer

During heating operation, the efficiency drops off sharply when the ambient temperature approaches 0°C

A defrost controller and a timer have been included in the safety control for defrost cycle.

Crankcase Heater

A crankcase heater of electric element type is fitted to the base of the compressor housing. When the compressor is idle, the crankcase heater is automatically switched on to cause the evaporation of the refrigerant and to prohibit the liquification of the refrigerant.

Other Safety Devices

Overcurrent relays are included for the compressor motor.

Interlock relays:

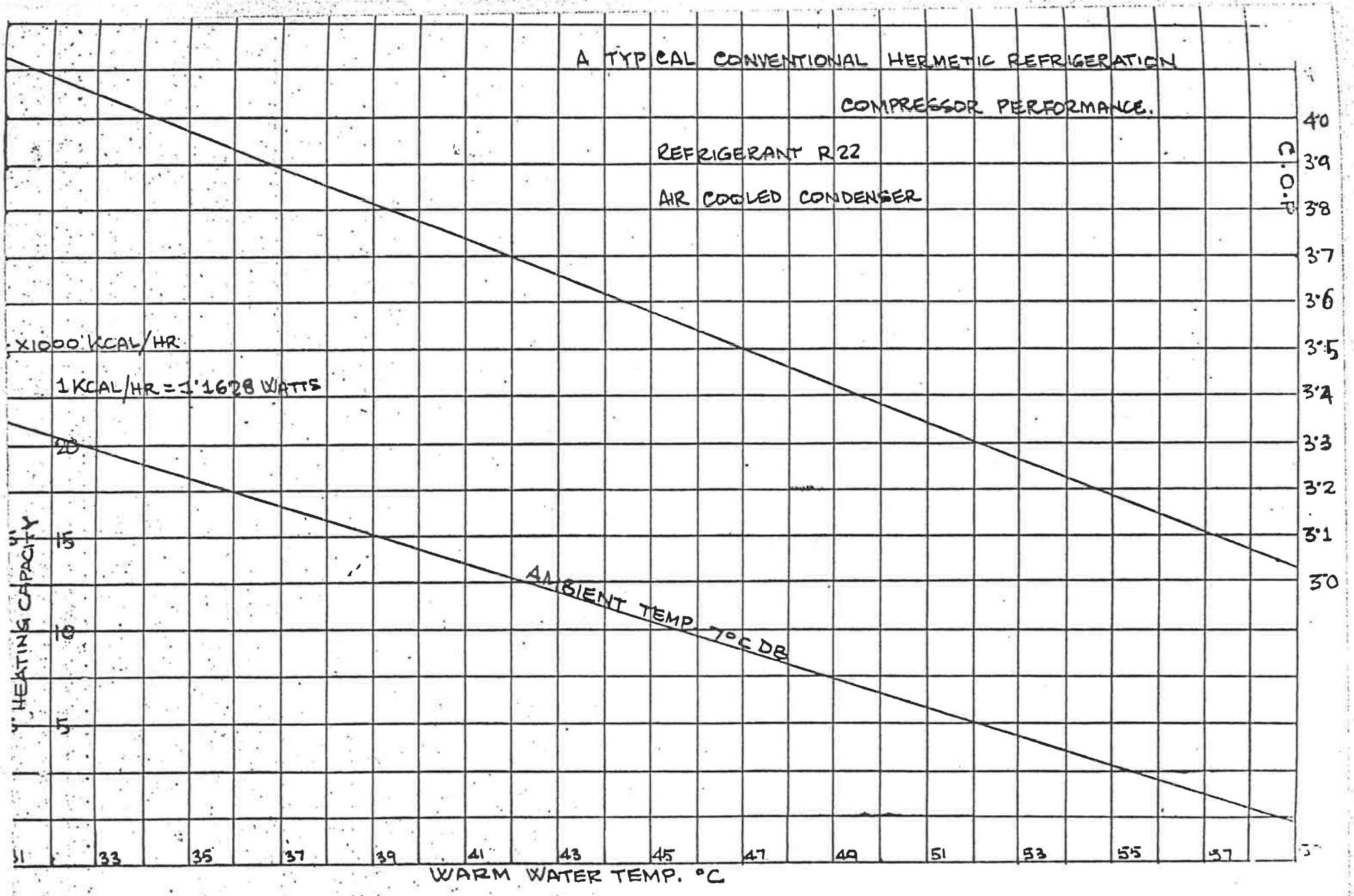
- Refrigeration Compressor motor and associated pump motor, to prohibit the operation of Compressor when the pump fails.
- By-pass damper motor and supply air fan motor, to prohibit the operation of By-pass system when the supply air fan fails.

The refrigeration Compressor stops by automatic means when

- the cold water temperature drops below the set point,
- the heat water temperature rises above the set point,
- the heat rejection fan fails to operate.

Heating and cooling modes are separated by a set of by-pass temperature sensors and a solenoid valve within the compressor motor operating circuit.

D.1.2 A Typical Hermetic Refrigeration Compressor Performance with Air Cooled Condensers


A TYPICAL CONVENTIONAL HERMETIC REFRIGERATION
COMPRESSOR PERFORMANCE.
REFRIGERANT R22
AIR COOLED CONDENSER
X1000 KCAL/HR
1 KCAL/HR = 1·1628 WATTS
Y HEATING CAPACITY
C.O.P.
AMBIENT TEMP. 7°C DB
WARM WATER TEMP. °C
20
15
10
5
4·0
3·9
3·8
3·7
3·6
3·5
3·4
3·3
3·2
3·1
3·0
31
33
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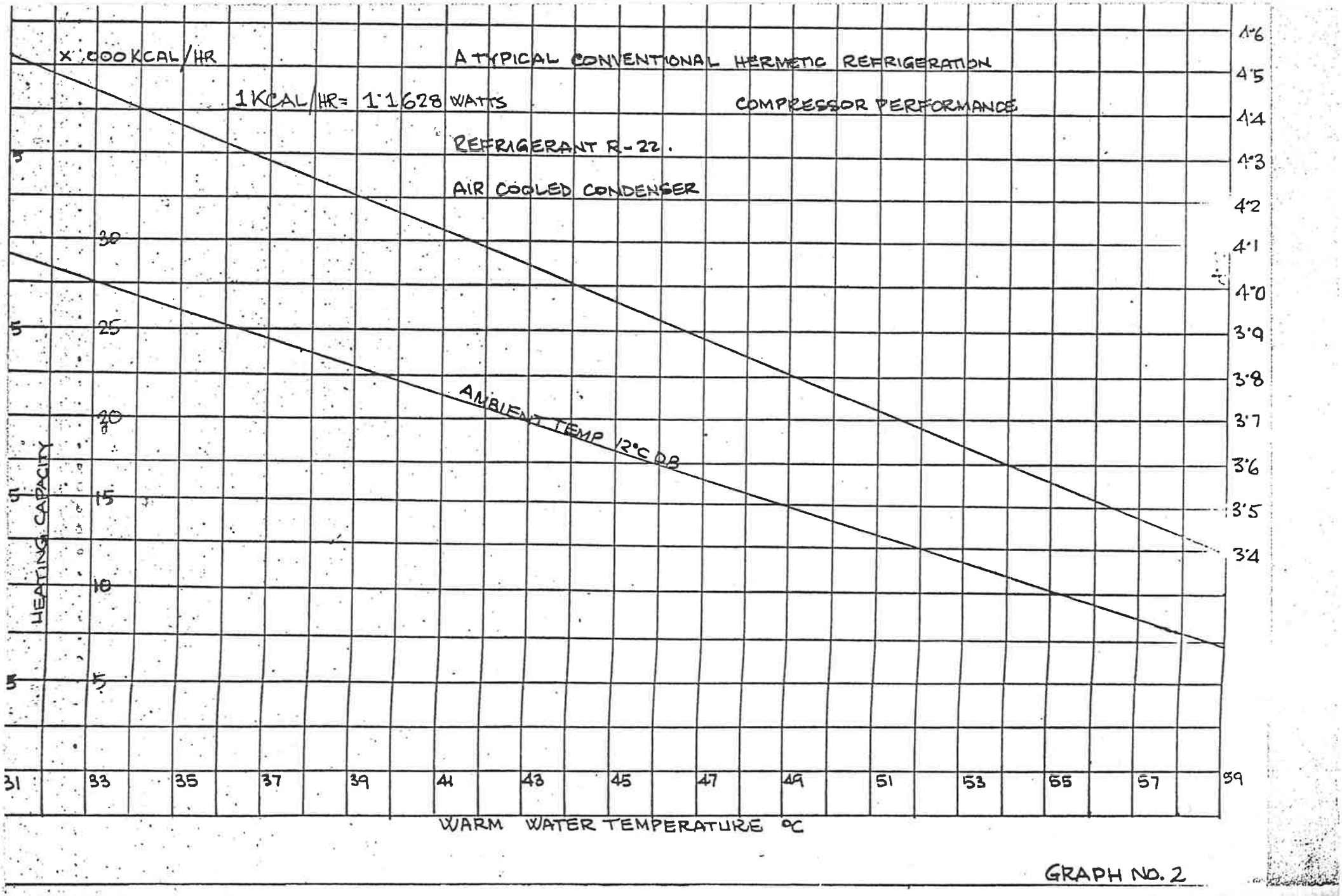
55
57

GRAPH NO. 1.


X 1000 KCAL/HR
A TYPICAL CONVENTIONAL HERMETIC REFRIGERATION
1 KCAL/HR = 1·1628 WATTS
COMPRESSOR PERFORMANCE
REFRIGERANT R-22.
AIR COOLED CONDENSER
AMBIENT TEMP 12°C DB
HEATING CAPACITY
WARM WATER TEMPERATURE °C
1·6
4·5
4·4
4·3
4·2
4·1
4·0
3·9
3·8
3·7
3·6
3·5
3·4
30
25
20
15
10
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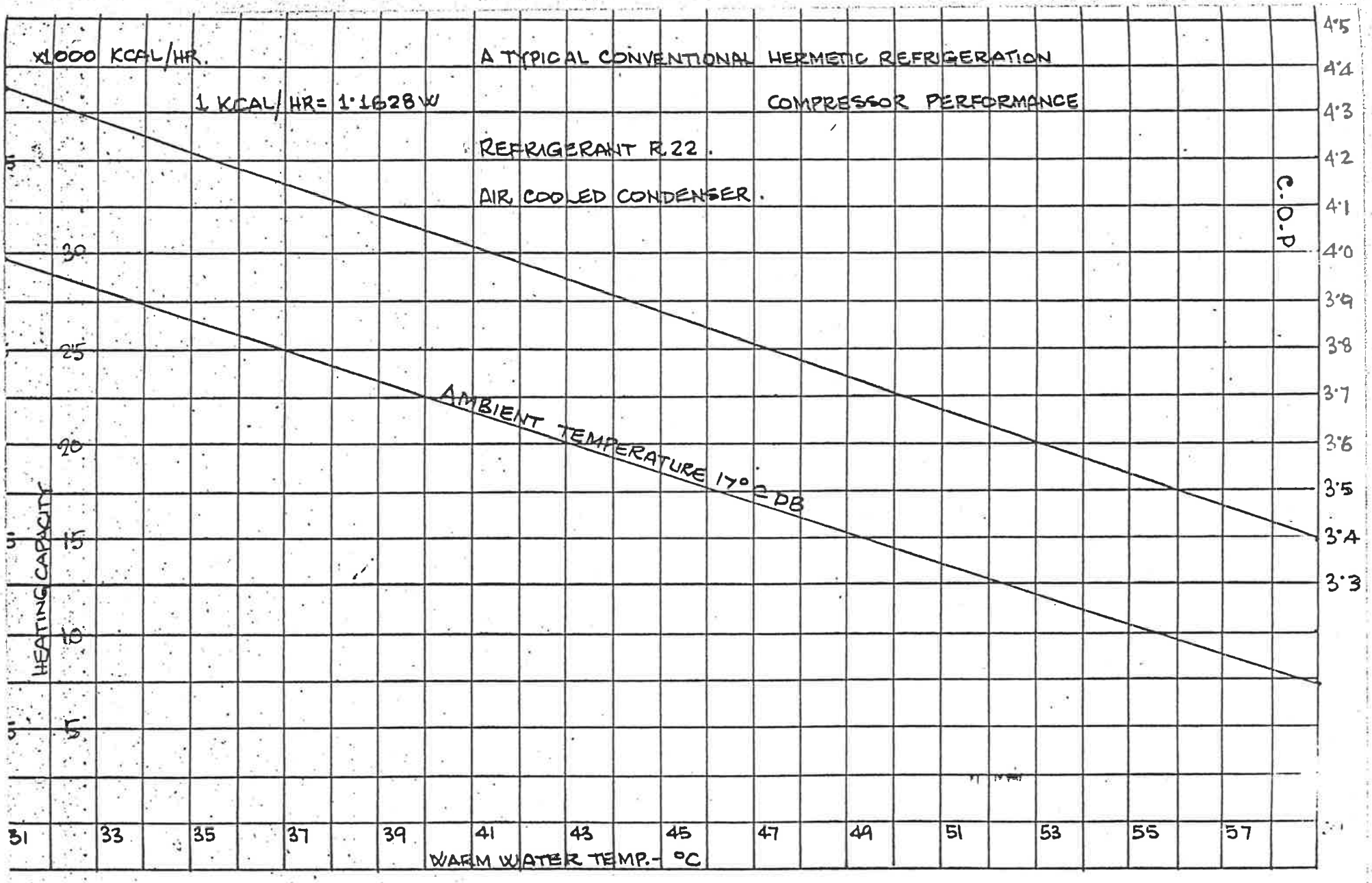
55
57
59

GRAPH NO. 2


x1000 KCAL/HR.
1 KCAL/HR = 1·1628 W
A TYPICAL CONVENTIONAL HERMETIC REFRIGERATION
COMPRESSOR PERFORMANCE
REFRIGERANT R.22.
AIR COOLED CONDENSER.
AMBIENT TEMPERATURE 17° C DB
HEATING CAPACITY
C.O.P
4·5
4·4
4·3
4·2
4·1
4·0
3·9
3·8
3·7
3·6
3·5
3·4
3·3
30
25
20
15
10
5
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41
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49
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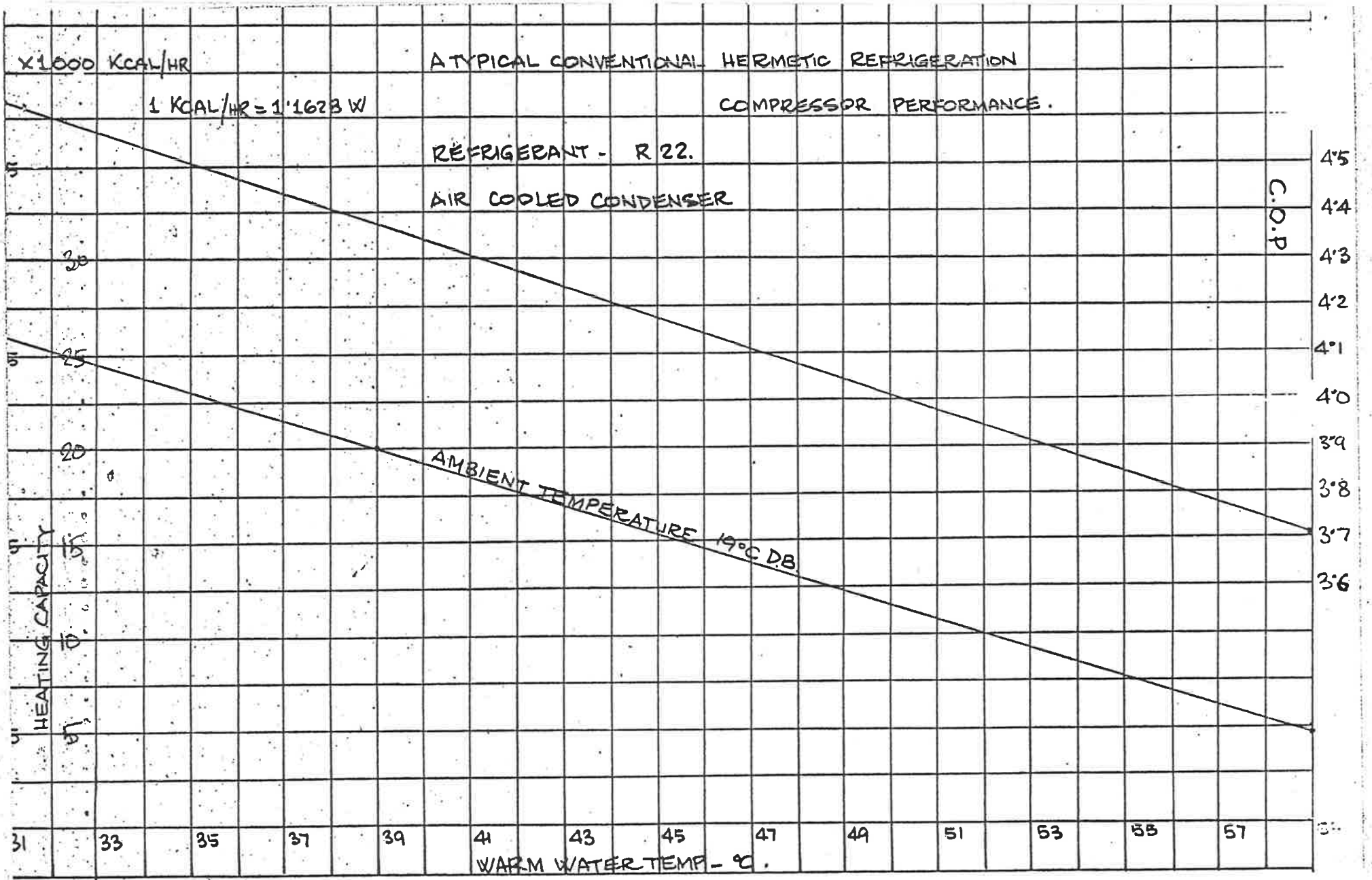
53
55
57
WARM WATER TEMP.- °C

GRAPH NO. 3


X1000 KCAL/HR
1 KCAL/HR = 1·1628 W
A TYPICAL CONVENTIONAL HERMETIC REFRIGERATION
COMPRESSOR PERFORMANCE.
REFRIGERANT - R 22.
AIR COOLED CONDENSER
AMBIENT TEMPERATURE 19°C DB.
HEATING CAPACITY
C.O.P
4·5
4·4
4·3
4·2
4·1
4·0
3·9
3·8
3·7
3·6
30
25
20
15
10
5
31
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45
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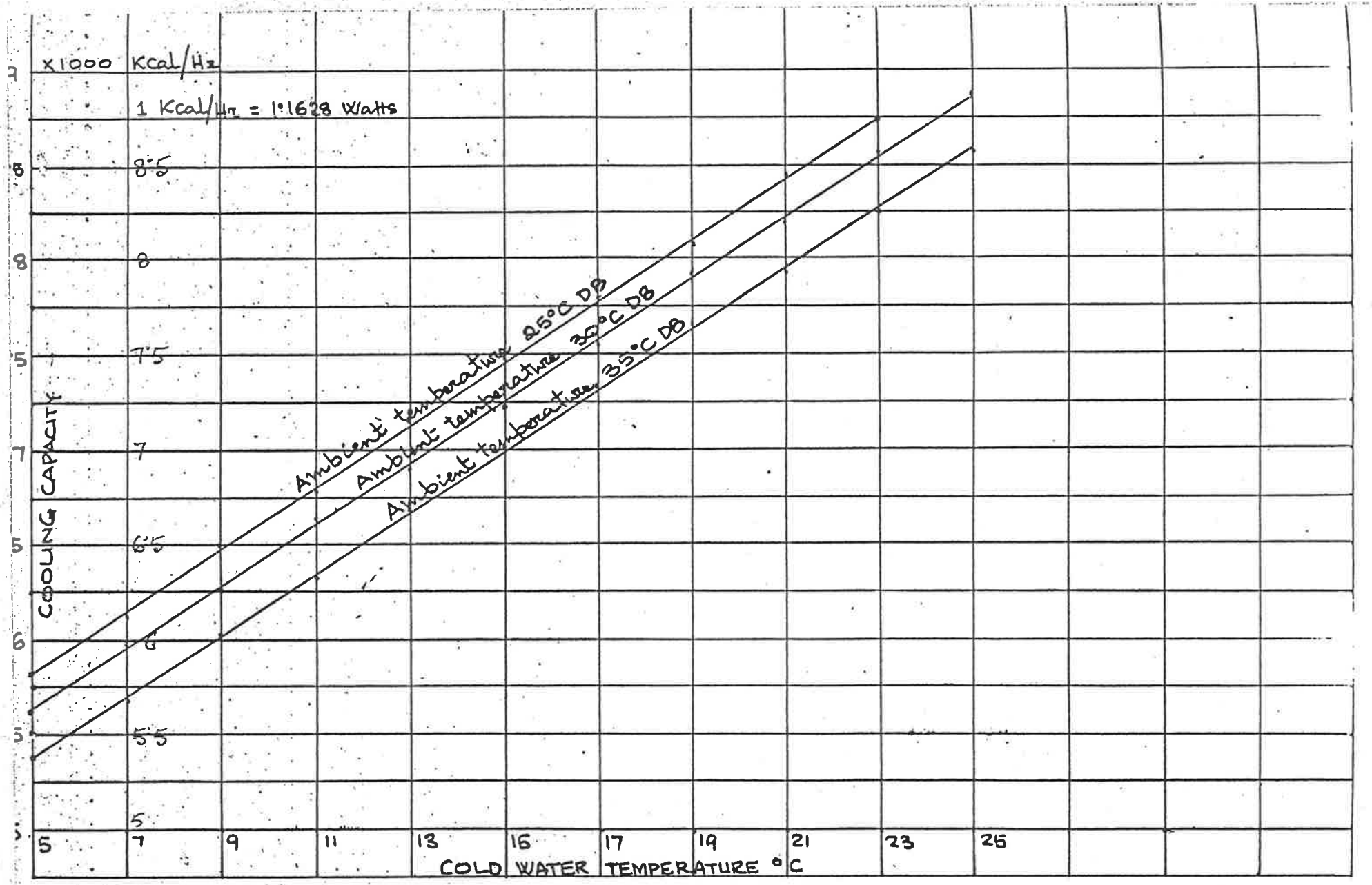
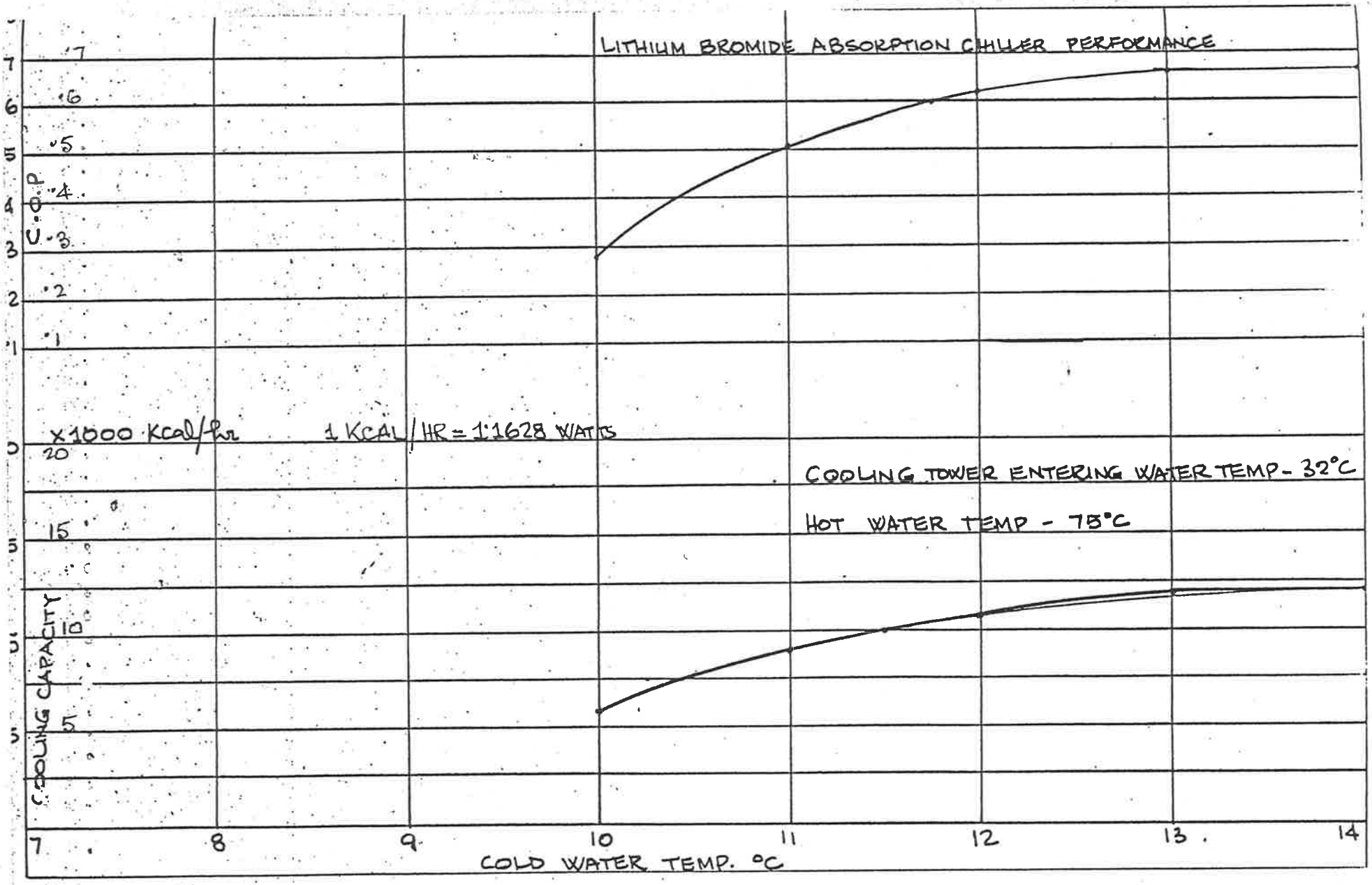
57
WARM WATER TEMP - °C.

GRAPH NO. 4

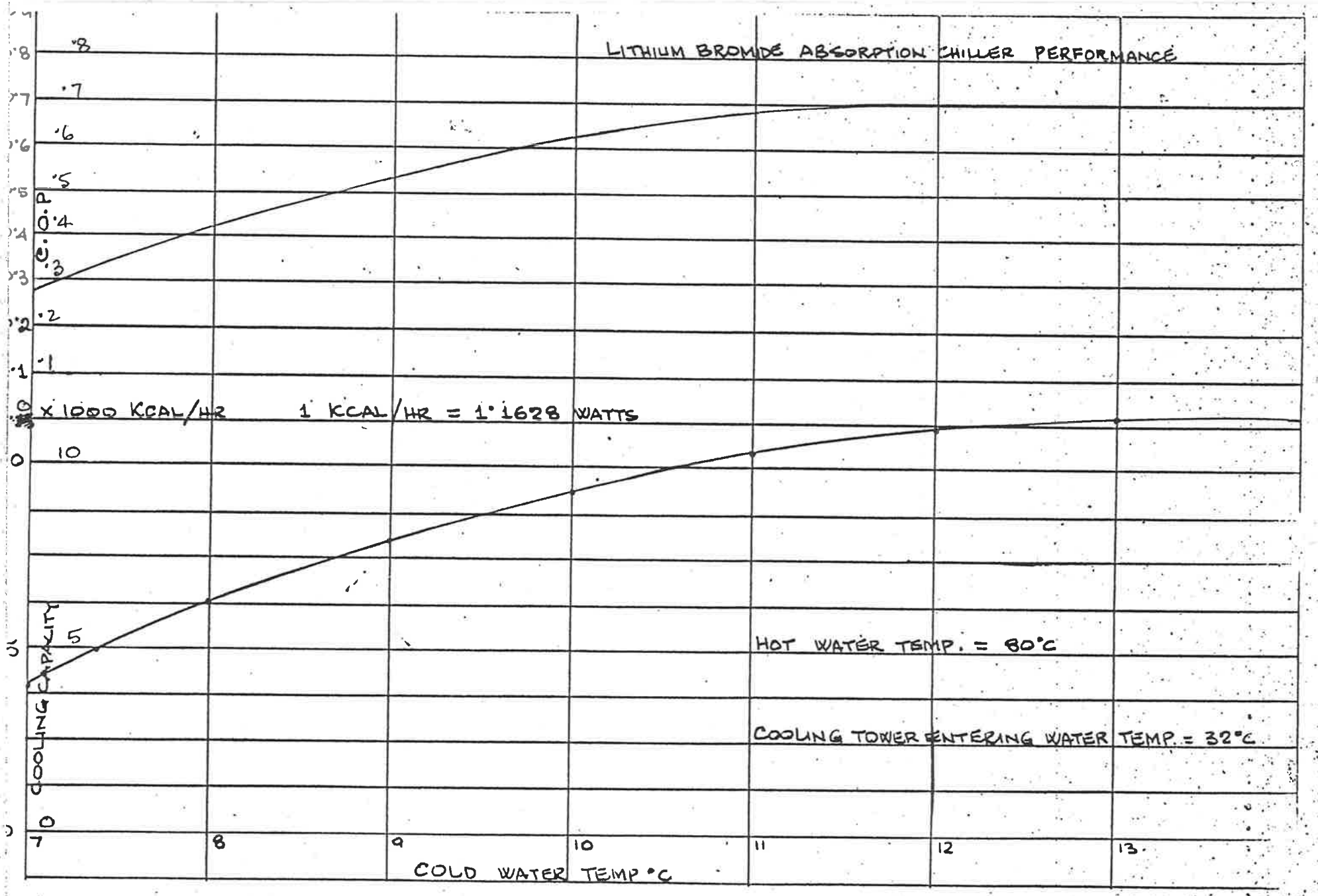

x1000 Kcal/Hr
1 Kcal/Hr = 1·1628 Watts
8·5
8
7·5
7
6·5
6
5·5
5
COOLING CAPACITY
Ambient temperature 25°C DB
Ambient temperature 30°C DB
Ambient temperature 35°C DB
5
7
9
11
13
16
17
19
21
23
25
COLD WATER TEMPERATURE °C

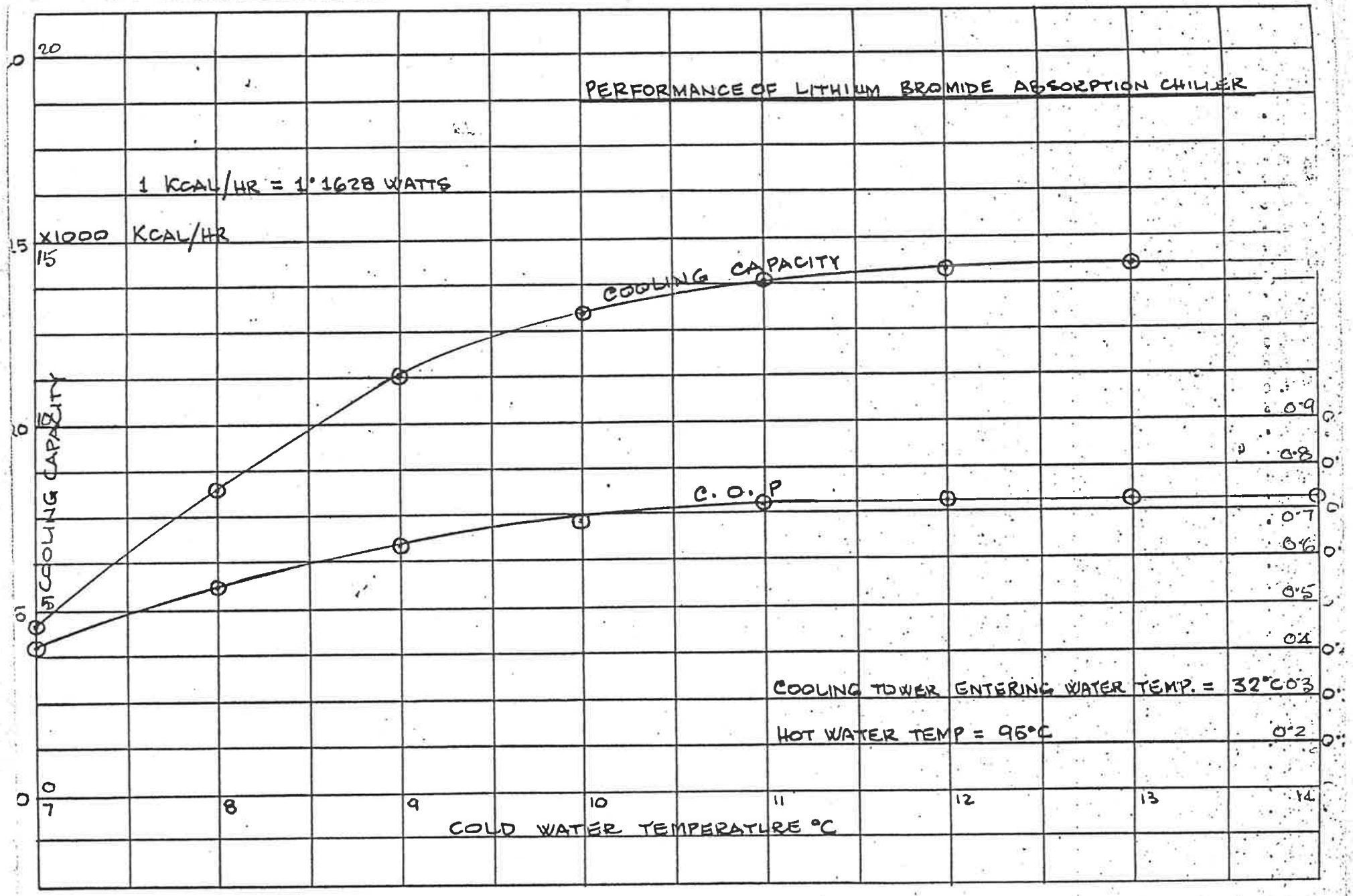
GRAPH NO 5

D.1.3 A Typical Lithium Bromide Absorption Chiller Performance with Water Cooled Condensers


LITHIUM BROMIDE ABSORPTION CHILLER PERFORMANCE
C.O.P.
7
6
5
4
3
2
1
X1000 Kcal/hr
20
15
10
5
COOLING CAPACITY
1 KCAL/HR = 1·1628 WATTS
COOLING TOWER ENTERING WATER TEMP - 32°C
HOT WATER TEMP - 75°C
7
8
9
10
11
12
13
14
COLD WATER TEMP. °C

GRAPH NO. 7


LITHIUM BROMIDE ABSORPTION CHILLER PERFORMANCE
.8
.7
.6
.5
.4
.3
.2
.1
0
C.O.P
X 1000 KCAL/HR
1 KCAL/HR = 1·1628 WATTS
10
5
0
COOLING CAPACITY
HOT WATER TEMP. = 80°C
COOLING TOWER ENTERING WATER TEMP. = 32°C
7
8
9
10
11
12
13
COLD WATER TEMP °C


PERFORMANCE OF LITHIUM BROMIDE ABSORPTION CHILLER
1 KCAL/HR = 1·1628 WATTS
X1000 KCAL/HR
COOLING CAPACITY
C.O.P
COOLING TOWER ENTERING WATER TEMP. = 32°C
HOT WATER TEMP = 96°C
COLD WATER TEMPERATURE °C
7
8
9
10
11
12
13
14
0
5
10
15
20
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2

D.2 MATHMATICAL CALCULATIONS, MODELS AND COMPUTER PROGRAMS

D.2.1 Transient Energy Flow through Walls and Roof

TRANSIENT ENERGY FLOW THROUGH WALLS AND ROOF

Transient heat conduction is characterised by "Time Dependant" heat-flow and temperature pattern within a conducting body.

If we consider that the surface temperature varies in a sinusoidal manner and if we assume that the plane slab is of infinite thickness, the temperature motion within the material can be assessed from its surface variation. If we neglect the edge losses and further we consider that the cyclic variation of temperature at the surface has been going on for a time sufficiently long for temperature elsewhere in the same slab to be repeated identically in each cycle, then the interior temperature cycle lags behind the surface variation, depending on the depth and, in addition, has a diminished amplitude compared with the maximum surface values. This type of analysis finds application wherever a cyclic variation of temperature occurs, as in annual or daily temperature variations of BUILDINGS OR THE energy gain on the surfaces exposed to the SOLAR RADIATION.

If the surface of the slab has a mean temperature t, and it varies in a sinusoidal manner between an upper temperature limit of $(t + (\theta_m)_o)$ and a lower limit of $(t - (\theta_m)_o)$. Thus if θ is the actual temperature difference between the temperature at any instant and the mean value, then at the surface where

$$x = 0$$

θ varies between

$$+(\theta_m)_o \text{ and } -(\theta_m)_o.$$

where θ_m denotes the maximum difference.

Further at some depth x in the slab, θ varies ~~varies~~ between

$$+(\theta_m)_x \text{ and } -(\theta_m)_x.$$

The frequency of the temperature variation is n cycles per unit time, so $1/n$ is the period of variation.

The boundary conditions can be set by the sinusoidal temperature variation at the surface, given by

$$\theta = (\theta_m)_0 \sin(2\pi n t)$$

which is the value of θ at $x = 0$ and $t = t$.

At $x = 0$,

$t = 0$,

θ is equal to 0.

$2\pi n$ is the angular velocity of the sine wave in rads/unit time.

Differentiating under unsteady conditions and considering one-dimensional flow,

$$\frac{\partial \theta}{\partial t} = \alpha\left(\frac{\partial^2 \theta}{\partial x^2}\right)$$

where

$$\alpha = K/\rho C_p = \text{thermal diffusivity.}$$

Thermal diffusivity is a ratio of the heat conduction to heat storage qualities of the material.

Since θ varies sinusoidally at the surface, it can also be expected to do so within the fabric material of the boundary, but between reducing limits.

The general form of solution of this differential equation requires the inclusion of constants and exponential expression.

θ can be expressed as

$$\theta = C \cdot e^{-px} \sin(2\pi nt - qx)$$

where C, p, q are constants.

Now $\dfrac{\partial\theta}{\partial t} = 2\pi n \cdot C \cdot e^{-px} \cos(2\pi nt - qx)$

$$\frac{\partial\theta}{\partial x} = -pC e^{-px} \sin(2\pi nt - qx) - q \cdot C \cdot e^{-px} \cos(2\pi nt - qx)$$

$$\begin{aligned}\frac{\partial^2\theta}{\partial x^2} &= p^2 C e^{-px} \sin(2\pi nt - qx) \\ &+ pqC e^{-px} \cos(2\pi nt - qx) \\ &+ pqC e^{-px} \cos(2\pi nt - qx) \\ &- q^2 C e^{-px} \sin(2\pi nt - qx)\end{aligned}$$

$\therefore$ $\dfrac{\partial\theta}{\partial t} = \alpha \cdot \dfrac{\partial^2\theta}{\partial x^2}$ becomes

$$\begin{aligned}&2\pi n \cdot C \cdot e^{-px} \cos(2\pi nt - qx) \\ &= \alpha \left[C \cdot e^{-px} (p^2 - q^2) \sin(2\pi nt - qx) \right. \\ &\qquad \left. + 2pq \cdot C \cdot e^{-px} \cos(2\pi nt - qx) \right]\end{aligned}$$

Cancelling the terms C and e^{-px}, we have

$$2\pi n \cdot \cos(2\pi nt - qx) = \alpha \left[(p^2 - q^2) \sin(2\pi nt - qx) + 2pq \cos(2\pi nt - qx) \right]$$

Applying the initial conditions that $t = 0$ at $x = 0$, we have

$$2\pi n - 2pq\alpha = 0$$

and $p^2 - q^2 = 0$ as the sine term disappears at the initial conditions.

$$\therefore \quad p q r = \pi n/\alpha$$

and $p^2 = q r^2$

or $p = q r$

i,e $p = q r = \pm \sqrt{\pi n/\alpha}$

The negative expression of this solution can be neglected as this has no mathematical meaning.

$$\therefore \quad \theta = C \cdot \exp\left[-x(\pi n/\alpha)^{0.5}\right] \operatorname{Sin}\left[2\pi n t - x(\pi n/\alpha)^{0.5}\right]$$

This result may now be compared with the boundary conditions when t becomes equal to t at $x = 0$,

i,e $\theta = C \operatorname{Sin} 2\pi n t$

and the boundary conditions give

$$\theta = (\theta_m)_0 \operatorname{Sin} 2\pi n t$$

Thus comparing the two above equations, we have

$$C = (\theta_m)_0$$

So we have

$$\theta = (\theta_m)_0 \exp\left[-x(\pi n/\alpha)^{0.5}\right] \operatorname{Sin}\left[2\pi n t - x(\pi n/\alpha)^{0.5}\right]$$

From this equation it is evident that the maximum variation of θ decreases exponentially with x and

$$(\theta_m)_x = (\theta_m)_0 \exp\left[-x(\pi n/\alpha)^{0.5}\right]$$

and that a temperature wave propagates into the fabric material and also that the cyclic variation of temperature

at some depth x lags behind the surface variation. The phase difference at depth x is given by

$$x(\pi n/\alpha)^{0.5}$$

Hence the time lag can be obtained from

$$2\pi n\,\Delta t = x(\pi n/\alpha)^{0.5}$$

$$\Delta t = \frac{x}{2}\left(\frac{1}{\pi n \alpha}\right)^{0.5}$$

The ratio of maximum temperature variations about the "MEAN" may be expressed in terms of

$$\frac{(\theta_m)_x}{(\theta_m)_0} = \exp\left[-x(\pi n/\alpha)^{0.5}\right]$$

But we need to determine the distance x at which $(\theta_m)_x$ has decreased to a certain percentage of $(\theta_m)_0$ which is of vital importance. To achieve this objective, we can express

$$x = \frac{I_n (\theta_m)_0 / (\theta_m)_x}{(\pi n/\alpha)^{0.5}}$$

The heat transfer rate for the energy to flow from higher region to lower region can be expressed by

$$q = Q/A = -k\left(\frac{\partial \theta}{\partial x}\right)_{x=0}.$$

From the above analysis,

$$\left(\frac{\partial \theta}{\partial x}\right)_{x=0} = -(\theta_m)_0 (\pi n/\alpha)^{0.5}\left[\sin 2\pi n t + \cos 2\pi n t\right]$$

Simulating an identity, such as,

$$\sin(2\pi n t + \pi/4) = (1/\sqrt{2})(\sin 2\pi n t + \cos 2\pi n t)$$

. can establish

$$\left(\frac{\partial\theta}{\partial x}\right)_{x=0} = -(\theta_m)_0 \left(2\pi n/\alpha\right)^{0.5} \sin\left(2\pi nt + \pi/4\right)$$

The total heat transfer at the wall can be expressed terms of $\int q \cdot dt = \int K(\theta_m)_0 \left(2\pi n/\alpha\right)^{0.5} \sin\left(2\pi nt + \pi/4\right) dt$

$$= -K(\theta_m)_0 \left(1/2\pi n\alpha\right)^{0.5} \cos\left(2\pi nt + \pi/4\right)$$

energy flow / unit area.

establish a realistic and practical approach to ergy storage facilities for both the passive and active tures of a building, it is necessary to develope the llowing criteria:

- Energy storage within the fabric materials based on specific heat and mass per unit area,
- Ratio of energy stored within the fabric materials to heat transfer rate,
- Depth and time lag relationship of temperature wave through the fabric materials.

hree computer programs have been established to assess e critical load conditions and to determine the essential pacities.

hese programs are :-

D.2.2 Energy Storage within the Fabric based on Specific Heat and Mass per Unit Area

PROGRAM NO. B1.

```
C - ENERGY STORAGE WITHIN THE FABRIC MATERIALS BASED
C   ON SPECIFIC HEAT AND MASS PER UNIT AREA.
C  T- INTERNAL SURFACE TEMPERATURE, °C
C  ET- EXTERNAL SURFACE TEMPERATURE, °C
C  ES - ENERGY STORED, WATT HOUR/M** 2.0.
C  M - MASS. KG PER M**2.0.
C  LIMIT OF HIGH SURFACE TEMPERATURES 1°C TO 70°C.
C  LIMIT OF LOW SURFACE TEMPERATURES 17°C TO 30°C.
      REAL M(8), T(14), ES(8)
      READ 1000,( T(I), I = 1,14)
 1000 FORMAT (14F3.0)
      READ 1010(M(K), K= 1,8)
 1010 FORMAT (8F4.0)
      DO 30 I = 1,14
      PRINT 2000, T(I)
 2020 FORMAT ( 1H1, 40X,' INTERIOR SURFACE
     1TEMPERATURE = ', F3.0,' °C'//)
      PRINT 2010,(M(K), K= 1,8)
 2010 FORMAT(8X,' ET.', 9X, F4.0, 10X, F4.0, 10X, F4.0
     1 10X, F4.0, 10X, F4.0, 10X, F4.0, 10X, F4.0, 10X,
     2F4.0)
      DO 30 N = 1, 70
      DO 50 K = 1, 8
   50 ES(K) = 0.23222 *(M(K) *(N-(T(I))
   30 PRINT 2020, N,( ES(K), K = 1,8)
 2020 FORMAT(8X, I2,8X, F8.2, 6X, F8.2, 6X, F8.2, 6X,
     1F8.2, 6X, F8.2, 6X, F8.2, 6X; F8.2, 6X, F8.2)
      STOP
      END
```

T(14) = 17 18 19 20 21 22 23 24 25 26 27 28 29 3

M(8) = 100 200 350 400 500 600 700 800

D.2.3 Ratio of Energy Stored within the Fabric to Heat Transfer Rate

D.2.4 Depth and Time Lag Relationship of the Fabric

PROGRAM NO. B2

```
C RATIO OF ENERGY STORED WITHIN THE FABRIC MATERIALS
C TO HEAT TRANSFER RATE.
C ER - RATIO ENERGY STORED TO HEAT TRANSFER RATE
C V- FREQUENCY OF TEMPERATURE VARIATION * TIME. RADIANS
C B - 1.Ø/FREQUENCY OF TEMPERATURE VARIATION, THAT IS,
C PERIOD OF VARIATION. HOURS PER CYCLE.
C T - TIME OF TRAVEL. HOURS.
      REAL V(12), B(8), T(8), ER(8)
      READ 1Ø4Ø,( V(I), I = 1,12)
1Ø4Ø  FORMAT (12F6.3)
      READ 1Ø5Ø, (B(K), K = 1,8)
1Ø5Ø  FORMAT (8F6.3)
      DO 5Ø I = 1, 12
      PRINT 2Ø1Ø, V(I)
2Ø1Ø  FORMAT ( 1H1, 3Ø X,' FREQ. OF TEMP.
     1 VARIATION * TIME = ', F6.3,'RADIANS.'
     2 /)
      PRINT 2Ø2Ø, (B(K), K = 1,8)
2Ø2Ø  FORMAT(5ØX,'TIME.' //8X, F6.3,7X,F6.3,
     1 7X, F6.3,7X, F6.3,7X, F6.3,7X, F6.3,
      7X, F6.3, 7X, F6.3/)
      DO 14 K = 1,8
14    T(K) = (V(I))/(B(K))
      PRINT 2Ø3Ø,(T(K), K = 1,8)
2Ø3Ø  FORMAT(8X, F6.3, 7X, F6.3,7X, F6.3,7X,
     1 F6.3, 7X, F6.3, 7X, F6.3, 7X, F6.3, 7X,
     2 F6.3)
      PRINT 2Ø4Ø, (B(K), K= 1,8)
2Ø4Ø  FORMAT( 4ØX,'ENERGY RATIO FACTORS.' //8X,
     1 F6.3, 8X, F6.3, 8X, F6.3, 8X, F6.3, 8X,
     2 F6.3, 8X, F6.3, 8X, F6.3, 8X, F6.3,
      DO 15 K = 1,8
15    ER(K) = 6.2857 *(B(K)) * TAN(6.2857 *(V(I))
```

```
     1+0·7854)
  5Ø  PRINT 2Ø5Ø,(ER(K), K= 1,8)
2Ø5Ø. FORMAT(8X, F6·3, 8X, F6·3, 8X, F6·3, 8X, F6·3, 8X,
     1 F6·3, 8X, F6·3, 8X, F6·3, 8X, F6·3)
      STOP
      END
```

V(12) = 0·000 0·012 0·024 0·036 0·048 0·060 0·072
0·084 0·096 0·108 0·120 0·124

B(8) = 2·000 1·000 0·250 0·125 0·083 0·063
0·050 0·042

PROGRAM NO. B3

```
C  DEPTH AND TIME LAG RELATIONSHIP OF TEMPERATURE WAVE
C  THROUGH THE FABRIC MATERIALS.
C  A- THERMAL DIFFUSIUMY OF MATERIAL. SQ M PER HOUR.
C  B- 1·Ø/FREQUENCY OF TEMP. VARIATION. THAT IS. PERIOD OF
C  VARIATION. HOUR PER CYCLE.
C  C-TIME LAG. HOURS.
C  D - BOUNDARY LAYER DEPTH. M
C  TRATIO - PERCENTAGE. LOW/HIGH TEMP. RATIO
      REAL A(10), B(8), D(8)
      DIMENSION C(8)
      READ 51Ø, J
 51Ø  FORMAT (I2)
      READ 1Ø2Ø, (A(I), I = 1,J)
 1Ø2Ø FORMAT ( 10F7·4)
      READ 1Ø3Ø (B(K), K = 1,8)
 1Ø3Ø FORMAT (8F6·3)
      DO 30 I = 1, J
      PRINT 2Ø6Ø, A(I)
 2Ø6Ø FORMAT( 1H1, 50X, 'THERMAL DIFFUSIUITY = ', F7·4,
     ' SQ. M. PER HOUR.'//)
```

```
      PRINT 2070,(B(K),K=1,8)
2070  FORMAT(4X,'TRATIO.',6X,F6.3,8X,F6.3,8X,F6.3,8X,
     1F6.3,7X,F6.3,8X,F6.3,8X,F6.3,8X,F6.3,8X,F6.3,
     28X,F6.3)
      DO 23 N = 1,100
      DO 17 K = 1,8
      RN = N
   17 D(K) = 1.29882*ALOG10(RN)/(SQRT((B(K))/
     1(A(I))))
   23 PRINT 2080,N,(D(K),K=1,8)
2080  FORMAT(6X,I3,8X,F6.3,8X,F6.3,8X,F6.3,8X,
     1F6.3,8X,F6.3,8X,F6.3,8X,F6.3,8X,F6.3,8X,
     2F6.3,8X,F6.3//)
      PRINT 2070,(B(K),K=1,8)
      DO 30 N = 1,100
      DO 25 K = 1,8
      RN=N
   17 D(K) = 1.29882*ALOG10(RN)/(SQRT((B(K))/
     1(A(I))))
   25 C(K) = 0.28038*D(K))*(1.0/(SQRT((A(I))*
     1(B(K)))))
   30 PRINT 2080,N,(C(K),K=1,8)
      STOP
      END
```

A(10) = 0.0001 0.0002 0.0004 0.0008 0.0012
0.0016 0.0020 0.0024 0.0028 0.0032

B(8) = 2.000 1.000 0.250 0.125 0.083 0.063
0.050 0.042

D.2.5 Geometry of Solar Radiation and Its Applications

GEOMETRY OF SOLAR RADIATION AND ITS APPLICATIONS

GENERAL

Solar radiation has great influence on the design and development of any environmental control System.

Solar radiation Comprises the following components:

- beam
- diffuse
- reflected Component from the Surroundings.

Beam radiation is that Solar radiation received from the Sun without any change in the direction.

Diffuse radiation is that Solar radiation received from the Sun after its direction has been changed by reflection and Scattering by the atmosphere.

Absorption of radiation in the atmosphere in the Solar energy spectrum is due largely to OZONE in the ultraviolet range and water vapour in the infrared band.

The Solar Constant, I_{sc} is the energy from the Sun, per unit time, received on a unit area of Surface perpendicular to the radiation, in space, at the earths mean distance from the Sun.

More recently, the availability of very high altitude aircraft, balloons, and space craft has permitted direct measurements of Solar intensity outside most or all of the earth's atmosphere. These measurements have been reviewed and

summerised and a new standard value of the Solar Constant proposed by THEKAKARA and DRUMMOND (1971) is 1353 W/m^2.

DIRECTION OF BEAM RADIATION

The geometric relationships between a plane of any particular orientation relative to the earth at any time (whether that plane is of static or dynamic configuration) and the incoming solar radiation, that is, the position of the Sun relative to that plane, can be described in terms of several angles. These angles, and the relationships between them (established by Benford and Bock, 1939) are:

ϕ = Latitude (North +ve, South −ve)

δ = Declination, the angular position of the Sun at Solar noon with respect to the plane of the equator (North +ve. South −ve)

S = Angle between the horizontal and the plane,

γ = Surface Azimuth Angle, the deviation of the normal to the surface from the local meridian, the zero point being due North in Southern Hemisphere, east positive, west negative.

W = Hour Angle, Solar noon being zero, and each hour equalling 15° of longitude with mornings +ve and afternoons −ve.

θ = Angle of Incidence, the angle being measured between the beam and the normal to the plane,

The DECLINATION, δ, can be found from the approx. equation of COOPER (1969).

$$\delta = 23.45 \sin\left[360 \times \frac{284+N}{365}\right]$$

where

N is the day of the year.

The RELATIONSHIP between θ and the other angles can be expressed in terms of

$$\cos\theta = \sin\delta \sin\phi \cos S - \sin\delta \cos\phi \sin S \cos\gamma$$
$$+ \cos\delta \cos\phi \cos S \cos\omega$$
$$+ \cos\delta \sin\phi \sin S \cos\gamma \cos\omega$$
$$+ \cos\delta \sin S \sin\gamma \sin\omega .$$

Considering that

θ_z = Zenith Angle, the angle between the beam and the Vertical

α = Solar Altitude Angle, the angle between the beam and the horizontal

$= 90° - \theta_z$,

the Sunrise hour angle, ω_s can be calculated when

$\theta_z = 90°$?

$$\cos W_s = - \frac{\sin\phi \sin\delta}{\cos\phi \cos\delta}$$

$$\therefore W_s = \cos^{-1}\left[-\tan\phi \tan\delta\right]$$

where

W_s = Sunrise Hour Angle.

The DAY LENGTH is of great importance when establishing the load criteria for any environmental control system

i,e

$$T_d = \frac{2}{15} \cos^{-1}\left(-\tan\phi \tan\delta\right)$$

where

T_d = DAY LENGTH

Solar radiation outside the atmospheric boundary for the same location is of some interest and this radiation level can be calculated from an empirical formula ?

$$H_o = \frac{24}{\pi} \cdot I_{sc} \cdot \left(\left[1 + 0.033 \cos\left(\frac{360N}{365}\right)\right] \times \left[\cos\phi \cos\delta \sin W_s + \frac{2\pi W_s}{360} \sin\phi \cdot \sin\delta\right]\right)$$

(Duffie and Beckman, 1974)

There is no special case that can easily be illustrated geometrically except, perhaps, the trivial one of the Sun at noon when the azimuth (~~zenith~~) is 0, by definition. The general case is capable of geometrical treatment but, three dimensions being involved, it is expressed in terms of

$$\text{TAN AZ} = \frac{\text{SIN } \omega}{\text{SIN } \phi \text{ COS } \omega - \text{COS } \phi \text{ TAN } \delta}$$

where AZ = AZimuth Angle.

RATIO OF TOTAL RADIATION ON A TILTED SURFACE TO THAT ON A HORIZONTAL SURFACE

It is often necessary to convert data for hourly or average daily radiation on a horizontal surface to radiation on a tilted surface.

Liu and Jordan (1963) have expressed the following empirical formulae.

A surface tilted at slope S from the horizontal sees a portion of the sky dome which can be expressed in term of

$$(1{\cdot}0 + \cos S)/2{\cdot}0,$$

if the diffuse solar radiation is uniformly distributed over the sky dome.

The tilted surface also sees ground, or other surroundings and if those surroundings have

have a diffuse reflectance of ρ for solar radiation, the reflected radiation from the surroundings on the surface from total solar radiation is

$$(H_b + H_d)(1.0 - \cos S)\rho / 2.0$$

where H_b and H_d are the beam and diffuse components of the solar radiation on the horizontal surface.

If R_b is the beam radiation ratio, it can be expressed in terms of θ_z, the angle on the horizontal surface between the perpendicular and the direction of incidence and θ_T, the angle between the perpendicular to the inclined surface and the direction of incidence.

$$\therefore \quad R_b = \frac{\cos\theta_T}{\cos\theta_z} = \frac{\cos(\phi - s)\cos\delta\cos\omega + \sin(\phi - s)\sin\delta}{\cos\phi\cos\delta\cos\omega + \sin\phi\sin\delta}$$

If we can assume that most of the diffuse radiation comes from an apparent origin near the sun and the scattering is mostly forward, the angular correction factor for the diffuse component is essentially the same as that for the beam component.

Further if we assume that the diffuse component is uniformly distributed over the sky, then the diffuse radiation on a surface of other than horizontal orientation is dependent on only on how

much of the sky the surface sees. If a tilted surface reflect solar radiation equivalent to the sky, then the surface will receive the same diffuse radiation no matter what is its orientation. Under these assumptions, the correction factor to convert the diffuse radiation is always unity.

The radiation on a tilted surface, under these conditions is

$$H_T = H_b R_b + H_d$$

where H_T = Total solar radiation.

If R is the effective ratio of total solar energy on the tilted surface to that on the horizontal surface, then,

$$R = \frac{H_b}{H_T} R_b + \frac{H_d}{H_T} \cdot \left(\frac{1{\cdot}0 + \cos S}{2}\right) + \frac{(1{\cdot}0 - \cos S)\rho}{2}$$

Liu and Jordan suggest values of ground reflectance ρ of 0·2 when there is no snow and 0·7 when there is snow cover.

D.2.6 Solar Energy Exchange Through Glass

D.2.7 Monthly Mean Ambient Temperatures

SOLAR ENERGY EXCHANGE THROUGH GLASS

There is a great deal of variation in engineering practice regarding the assumption of wind speed and air film coefficient. For estimation of instantaneous load, air film coefficients for glass for various wind speeds have been taken from the experimental data prepared and tabulated by A.S.H.R.A.E.

Wind speed m/s	Air Film Coefficient W/ m². °C
0	8·4
1·0	10·5
2·0	15·0
2·5	16·7
3·0	18·2
4·0	21·2
5·0	24·1
6·0	26·5
7·0	28·9

The effectiveness of a shading device depends on its ability to keep solar heat from the conditioned space. The windows of the experimental house have internal shading devices and the exterior surfaces of the glass are shaded by the extended roof.

The solar heat gain through glass is expressed as follows:

$$Q' = [0{\cdot}4\alpha_g + \tau_g(\alpha_{sd} + \tau_{sd} + \rho_g \rho_{sd} + 0{\cdot}4\alpha_g \rho_{sd})]R$$

Q' = Solar heat gain to space, W/m^2

R = Incident Solar energy,

α = Solar absorptivity

τ = Solar transmissibility

ρ = Solar reflectivity

g = glass factor

S_d = Shading device factor

Solar characteristics and glass factor for clear plate glass (6 mm thick)

α_g	ρ_g	τ_g	Glass Factor
0.15	0.08	0.77	0.94

Solar characteristics for internal shading device are :

α_{sd}	ρ_{sd}	τ_{sd}
0.37	0.51	0.12

ENERGY STORAGE VESSELS / EXCHANGERS

Energy needs for any environmental control system are time-dependent. The major elements which have been considered to make a compromise between the time-dependent needs and the storage, are :

- the nature of variation of load and the proportional time response,
- the degree of reliability,
  flexibility,
  accessibility for maintenance,
- the transient temperature movement through the fabrics of a building separating the interior regions from the exterior regions and the time lag in sinusoidal motion,
- maximum daily temperature range within a 24-hour period and the transient period between maxima and minima while the equilibrium exists between two conditions, separated by the boundary fabrics,
- the economic justification of the predetermined capacity of the vessels

As the energy storage vessels are also used for the exchange of energy, momentum and matter,

the total heat transfer coefficients, energy gradients and the assumptions for constants over a predetermined range of low velocity, eddy contours and accelerated rates of diffusion are of great importance.

NATURE OF VARIATIONS OF LOAD AND THE PROPORTIONAL TIME RESPONSE.

Monthly mean ambient temperatures of the project locations are:

	Monthly mean 3 P.M Temp °C DB	Monthly mean max. temp °C D.B
January	26·83	29·33
February	28·11	29·83
March	24·94	26·83
April	21·27	22·77
May	17·5	17·5
June	14·6	16·11
July	14·05	15·5
August	15·33	17·33
September	17·27	17·33
October	20·38	22·5
November	23·11	25·61
December	26·16	28·11

D.2.8 Average Ambient Temperature Distribution

Average ambient temperature distribution over 365 days is as follows:

TEMP. RANGE °C DB	NO. OF DAYS
4·5 – 10	2
11 – 15·5	102
16·5 – 21	129
22 – 26·5	76
27·5 – 32	34
33 – 37·5	17
38·5 – 43	5
TOTAL	365

It is to be noted that

- a period of 76 days equilibrium exists between the interior regions and the exterior regions
- a period of 233 days heating is required
- a period of 56 days cooling is required.

These data are approximate only.

D.2.9 Distribution of Global Radiation

Distribution of Global Radiation over 12 months is as follows:

January - March	700	mWh/cm²
April - June	355	"
July - September	200	"
October - December	545	"
Average daily amount all through the year	450	"

Variations of load are dependent on these meteorological data.

D.2.10 Declination, Day-Length, Sunrise Hour Angle

D.2.11 Zenith Angle, Solar Altitude Angle, Azimuth Angle

COMPUTATION SHEET — 5mm SQUARES

/.341

PROGRAM NO. A1·0

```
      STUDY DECLINATION, DAY LENGTH, SUNRISE HOUR ANGLE
      STUDY RADIATION OUTSIDE ATMOSPHERIC BOUNDARY.
      ANUSTRATION LOCATIONS ONLY.
      AI - IRRADIATION OUTSIDE BOUNDARY ATMOSPHERE. THOUSAN
      DI - DECLINATION - RADIANS.
      DT - DAY LENGTH HOURS
      HO - RADIATION OUTSIDE BOUNDARY ATMOSPHERE. THOUSAN
      DS - DAYLENGTH HOURS
      WS - SUNRISE HOUR ANGLE. ANGLE IS EXPRESSED IN TERM
      WS = COS(WS).
      DIMENSION L(8),J(8),(L(I),I=1,J)
      DATA L/0.,31.,59.,90.,120.,151.,181.,212./
      READ(5,1000) I,J
      READ(5,1000) I1,J1
 1000 FORMAT(2I10)
      READ(5,2000) (H(I),I=1,45X,45)
 2000 FORMAT(10F8.5)
      WRITE(6,2010)
 2010 FORMAT(1H1,45X,'LATITUDE= ',F8.5,' RADIANS(SO
     1UTH)')
      WRITE(6,2000)
      DO 10 N=I1,J1
      WS=-TAN(J)*TAN(D)
      COST=-WS*COS(WS)
      T=(ACOS(COST)+WS)*7.639437
      HO=-3530.*(D*SIN(D)+COS(D)-1.)*COS(J)*(SIN(WS)*
     2-WS*COS(WS))/3.1416
      DO=-0.4093*SIN(0.01721*(284.0+N))
      DS=2.*T
      IF(N.EQ.L(I)+1.AND.I.LE.J) GO TO 20
      GO TO 30
   20 I=I+1
   30 WRITE(6,2020) N,DO,DS,HO,WS
 2020 FORMAT(I5,4F10.3)
   10 CONTINUE
      GO TO 1
      END
```

Work/Title	Sheet Number
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COMPUTATION SHEET — 5mm SQUARES

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```
      PRINT 2020,N,D,T,COS WS,HO
 2020 FORMAT(32X,I3,4X,F8.5,10X,F8.4,7X,F8.5,13X,F
     1 8.1)
      10 CONTINUE
      STOP
      END
L(8)=-0.21729,-0.27053,-0.34168,-0.41247,-0.55763,-0
     1.59079,-0.60970,-0.66003
PROGRAM NO. A2.0
C STUDY ZENITH ANGLE, SOLAR ALTITUDE ANGLE, AZIMUTH
C ANGLE FOR AUSTRALIAN LOCATIONS.
C THZ-ZENITH ANGLE.RADIANS.
C THA-SOLAR ALTITUDE ANGLE.RADIANS.
C BAZ-AZIMUTH ANGLE.RADIANS.MORNING POSITIVE.SOLAR NOON
C G-HOUR ANGLE.RADIANS.MORNING POSITIVE.SOLAR NOON
C ZERO.AFTERNOON NEGATIVE
      REAL L(8),G(13)
      DIMENSION COS THZ(13),COS THA(13),TAN BAZ(13
     1),D(365)
      READ 5100,(J(I),I=1,J)
 5100 FORMAT (12I10)
      READ 1010,(L(K),K=1,8)
 1010 FORMAT (8F9.5)
      READ 1020,(G(K),K=1,13)
 1020 FORMAT (8F8.5)
      DO 2020 I=1,J
      DO 2020 N=1,L(I)
```

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COMPUTATION SHEET — 5mm SQUARES

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```
2Ø1Ø  FORMAT(1H1,4ØX,'LATITUDE=',FQ.5,'RADIANS.SOU
     TH.'/) 2Ø3Ø,(G(K),K=1,13)
2Ø3Ø  PRINT (5ØX,'/RADIANS FOR DAY HOURS'/3X,'DAY
     FDOUN) 23=1,365
     N=1.Ø4Ø928*SIN(Ø.Ø172Ø1*(284.Ø+N))
     DDOUN 17 K=1,13
17 1 CORSINE=(SIN(D(N))*SIN(L(I))+COS(D(N))*CO
     S(L(I))*COS(G(K)))THZ(K)
23   PRINT 3F9.5,3X,F6.3,3X,F6.3,3X,F6.3,3X,
2Ø4Ø 1 FDAY 3X,3I4,3X,F6.3,3X,F6.3,3X,F6.3)
     DDOUN 18 K=1,13
18 1 SCOSL=(SIN(L(I))*COS(G(K))-SIN(D(N))/(COS
     L(I)*SIN(L(I))*COS(G(K)))
34   PRINT 2Ø3Ø,365
     DDOUN 19 K=1,13
19   DTAN=(SIN(G(K))/(COS(G(K))*TAN(D(N)))
     ETOSUN=2Ø4Ø,N,(TAN(L(I))*TAN(D(N)))
2Ø   PRINT BAZ(K),K=1,13)
     STOP
     END
```

```
G(13)=1.57Ø8Ø,1.3Ø9ØØ,1.Ø472Ø,Ø.7854Ø,Ø.5236Ø,Ø.2
     618Ø,Ø.Ø,-Ø.2618Ø,-Ø.5236Ø,-Ø.7854Ø,-1.Ø472
     Ø,-1.3Ø9ØØ,-1.57Ø8Ø
```

Work/Title.	Sheet Number .
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D.2.12 Instantaneous Beam Radiation

D.2.13 Ratio of Diffuse Radiation on a Tilted Surface to That on a Horizontal Surface

D.2.14 Ratio of Reflected Radiation on a Tilted Surface to That on a Horizontal Surface

COMPUTATION SHEET — 5mm SQUARES

```
      PROGRAM NO.A3.0
C     STUDY OF INSTANTANEOUS BEAM RADIATION.(WATTS/M**
C     2.0)H/HO
C     RT=INSTANTANEOUS TOTAL SOLAR RADIATION PER UNIT
C     H-INSTANTANEOUS EXTRATERRESTRIAL RADIATION PER
C     AREA ON A HORIZONTAL SURFACE.
C     HO-INSTANTANEOUS HORIZONTAL SURFACE.(WATTS/M**2.0)
C     UNIT AREA ON A NORMAL TO THE SURFACE.(WATTS/M**2.0)
C     HDN - DIRECT NORMAL RADIATION.(WATTS/M**2.0)
C     HB - COMPONENT OF BEAM
      REAL L(8),G(13),HB(13),COS THZ(13),D(365)
      DIMENSION HDN(365)
      READ(5,20,END=27)(L(I),I=1,8)
   52 FORMAT(8F9.5)
      READ(5,20,END=27)(G(K),K=1,13)
 1030 FORMAT(8F9.5)
      READ(5,20,END=27)(D(N),N=1,365)
 1040 FORMAT(8F8.5)
      DO 2050 I=1,8
 2050 PRINT 1,I,L(I)
    1 FORMAT(1H1,45X,'LATITUDE=',F9.5,'RADIANS.SO
     1LUTIONS FOR',I3,'DAY')
      DO 2060 K=1,13
 2060 PRINT 50,K,G(K)
   50 FORMAT(5X,I3,'RADIANS FOR DAY HOURS'/3X,'DAY
     1 N=1.365')
      DO 27 N=1,365
      DOS=0.40928*SIN(0.01721*(284.0+N))
      DO 27 K=1,13
      COS THZ(K)=(SIN(D(N))*SIN(L(I))+COS(D(N))*
     1COS(L(I))*COS(G(K)))
      HDN(K)=249.9986/COS THZ(K)
   27 HB(K)=249.9986*COS THZ(K)
```

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COMPUTATION-SHEET — 5mm SQUARES

V.341

```
      PROGRAM NO. A4.0
C     RD-THE RATIO OF DIFFUSE RADIATION ON A TILTED
C     SURFACE TO THAT ON A HORIZONTAL SURFACE.
C     S-THE SLOPE FROM THE HORIZONTAL PLANE. RADIANS
C     COS00 =1.00 AND COS90 =0.
      REAL RD,S
      PRINT 2100
 2100 FORMAT (1H1,30X,'RADIANS',20X,'RD'/)
      RAD=0.0174533
      DO 33 K=1,13
      HB(K) =2070.(HB(K)
   33 PRINT 2070, (HB(K) ,K=1,13)
 2070 FORMAT (2X,13,5X,F6.2,4X,F6.2,3X,F6.
     1 2,3X,F6.2,2X,F6.2,2X
     2 ,F6.2,2X,F6.2,2X,F6.2)
      DO 28 K=1,13
      S=K*2.*RAD/26.
      D=COS(S)
      DO 29 N=1,13
      HDN=499.997*D
      HDN=HDN*999.
   28 HBC(K)=HDN
      PRINT 2070,(HBC(K),K=1,13)
      DO 35 K=1,13
      S=K*2.*RAD/26.
      D=COS(S)
      DO 30 N=1,13
      HDN=HDN*999.
   29 HBC(K)=HDN
      PRINT 2070,(HBC(K),K=1,13)
   30 STOP
      END.
```

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COMPUTATION SHEET — 5mm SQUARES

```
      PROGRAM NO. A5.0
C
C     RR-THE RATIO OF REFLECTED RADIATION ON A TILTED
C     SURFACE TO THAT ON A HORIZONTAL SURFACE.
C     ROW-GROUND REFLECTANCE.(LIU AND JORDAN)
      REAL ROW,RR,S
      PRINT 2120
 2120 FORMAT (1H1, 30X, 'ROW', 15X, 'RADIANS', 15X, 'RR'/)
      DO 55 I=1,6
      ROW=0.1+0.1*I
      RAD=0.0174532
      S=RAD*50.0
      DO 55 II=1,89
      S=S+RAD
      DS=COS(S)
      X=(COS(1.0-X))/2.0
      RR=(ROW*(1.0-X))/2.0
      PRINT 2130,ROW,S,RR
   55 CONTINUE
 2130 FORMAT (31X, F3.1, 14X, F10.8, 13X, F9.6)
      STOP
      END
```

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D.2.15 Beam Radiation Ratio for the Planes whose Inclinations are Equal to Latitude

PROGRAM NO. AG.0

```
C  BEAM RADIATION RATIO FOR THE PLANES WHOSE
C  INCLINATIONS ARE EQUAL TO LATITUDE.
C  NORTH ROOF RADIATION RATIO.
C  RB-BEAM RADIATION RATIO.
      REAL L(8), G(13), RB(13), D(365)
      DIMENSION J2(12), L(I), I=1,J)
      READ(5,200) J2
  520 FORMAT(8F8.2)
      READ(5,1030) (L(I), I=1,J)
 1030 FORMAT(8F8.2)
      READ(5,1040) (G(K), K=1,13)
 1040 FORMAT(8F8.2)
      PRINT 4050, H
 4050 FORMAT(' LATITUDE=', F9.5, 'RADIANS')
      SUM=0.0
      PRINT 4060
 4060 FORMAT(' DECLINATIONS FOR DAY HOURS'/3X,'DAY
     1 ',3X,'RADIANS',5X,'G(K)',3X,'RB(K)')
      DO 90 N=1,365
      DEC=0.4093*SIN(0.01721*(284.0+N))
      DD=1.0-0.033*COS(0.01721*N)
      DDR=DD*DD
      SUM=SUM+DDR
      IF(N.GT.365) GO TO 70
      DO 80 K=1,13
      RB(K)=DDR*(G(K)*COS(L(I))*COS(DEC)+SIN(L(I))
     2*SIN(DEC))
      IF(RB(K).LT.0.0) RB(K)=0.0
   80 CONTINUE
      PRINT 90, N, (RB(K), K=1,13)
   90 FORMAT(2X,I3,4X,F8.2,3X,F6.4,3X,F6.4,3X,F6.4
     1,3X,F6.4,3X,F6.4,3X,F6.4,3X,F6.4,3X,F6.4,3X,
     2F6.4,3X,F6.4,3X,F6.4,3X,F6.4,3X,F6.4)
   70 CONTINUE
      AVG=SUM/365.0
      PRINT 4070, AVG
 4070 FORMAT(' AVERAGE DAILY RADIATION RATIO=',F6.4)
      STOP
      END
```

Work/Title	Sheet Number
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D.2.16 Beam Radiation Ratio, Vertical Planes

W.341

```
C PROGRAM NO. A6.0 A7.0
C STUDY OF BEAM RADIATION RATIO.
C VERTICAL PLANES
C SOUTHEAST TO NORTHWEST POSITIVE TO NEGATIVE
C REPRESENTED BY SEN
C NORTHEAST TO SOUTHWEST POSITIVE TO NEGATIVE
C REPRESENTED BY NES
C WALLS ARE PRESENTED IN VERTICAL PLANES
      REAL L(8),G(13),NES(13)
      DIMENSION SEN(13)
      READ 500,(G(K),K=1,13)
      READ 500,(L(H),H=1,8)
  500 FORMAT (8F10.5)
      READ 1000,(SEN(K),K=1,13)
 1000 FORMAT (13F9.5)
      READ 1010,J
 1010 FORMAT (I2)
      DO 2010 I=1,J
      READ 2020,X,(NES(K),K=1,13)
 2020 FORMAT (F5.0,13F9.5)
      DO 16 K=1,13
      DO 16 H=1,8
      SEN(K)=0.70711*(SIN(G(K))+COS(G(K)))
   16 NES(K)=0.70711*(SIN(G(K))-COS(G(K)))
      DO 1 K=1,13
      N=1.365
      SI=0.47092
      D=ATAN(SI*(SIN(L(H))*TAN(D)-SIN(L(H))*COS(G(K))/(TAN(D)*SIN(L(H))+COS(L(H)
     2))*COS(G(K)))
      SI=0.01721*(284.0+N))
```

Work/Title	Sheet Number
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COMPUTATION SHEET — 5mm SQUARES

```
      PRINT 2050, (SEN(K), K=1,13)
2050  FORMAT (3X, 13, 3FQ.4, FQ.5, 2FQ.4, FQ.5, 2FQ.4, FQ
     1.5, 3FQ.4)
      PRINT 2020, (G(K), K=1,13)
      DO 30 N=1,365
      DO 26 K=1,13
      NES(K)=0.26404928*SIN(0.01721*(284.0+N))
     1-TAN(D)*COS(L(H)))/(TAN(D)*SIN(L(H))+COS(L(H
     2))*COS(G(K)))
      PRINT 2050, N, (NES(K), K=1,13)
30    STOP
      END
```

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D.2.17 Dynamic Viscosity of Water

```
C PROGRAM A~~1Ø~~Ø.A11·Ø
C STUDY OF DYNAMIC VISCOSITY OF WATER
C DISCUSSED THIS PROGRAM WITH BRITISH MINISTRY OF
C TECHNOLOGY AND SCIENCE
C TEMPERATURE RANGE Ø·C TO 1ØØ·C
C
C DV- DYNAMIC VISCOSITY NEWTON SECOND/SQUARE METR
C E.
C T- TEMPERATURE °C
      REAL DV
      T=272.65
      DO 1ØØ I=1,201
      T=T+Ø.5
      X=((2.Ø*T/273.15)-2.3669921)/Ø.3669921)
      T8R=1.Ø
      T1R=X
      T2R=((2.Ø**T1R-T8R)
      T3R=((2.Ø**T2R-T1R)
      T4R=((2.Ø**T3R-T2R)
      T5R=((2.Ø**T4R-T3R)
      T6R=((2.Ø**T5R-T4R)
      T7R=((2.Ø**T6R-T5R)
      T8R=((2.Ø**T7R-T6R)
      DV=(((Ø.76544973585*TØR-Ø.66285851 6*T1R+Ø.2488Ø
     2 34 7*T2R-Ø.Ø79736Ø135*T3R+Ø.Ø2589932*T4R-Ø
     2 ·ØØØ659669 31*T5R+Ø.ØØ27517948 8*T6R-Ø.ØØØ8248
     3 33*T7R+Ø.ØØØ27517948 8*T8R)/1ØØØ.Ø)
     4 PRINT 1ØØØ,T,DV
     5 FORMAT (25X,F6.2,35X,F18.6)
   1ØØ CONTINUE
       STOP
       END
```

Work/Title	Sheet Number
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D.2.18 Mass Diffusivity of Water Vapour

```
C PROGRAM NO. A11.Ø A12.Ø
C STUDY OF MASS DIFFUSIVITY OF WATER VAPOUR
C SPALDING EQUATION.
C ATM- ATMOSPHERE
C T-TEMPERATURE, °R.
C DC-DIFFUSION COEFFICIENT FT**2.Ø/HOUR
C TO CONVERT TO METRIC SYSTEM 1.ØM**2.Ø=1Ø.7639104
C FT**2.Ø. AND Ø.5°C=Ø.9°F AND 1 ATM STANDARD=1Ø
C 1.325 KPA.
      REAL ATM, DC
      ATM=Ø.997Ø3923
      DO 1ØØ II=1,3
      ATM=ATM+Ø.ØØ296Ø77
      T=491.67
      DO 1ØØ II=1,2ØØ
      T=T+Ø.9
      DC=(Ø.ØØØ146/ATM)*(T**2.5/(T+441.Ø))
      PRINT 1ØØØ, ATM, DC
 1ØØØ FORMAT (15X, F1Ø.8, 15X, F6.2, 15X, F7.3)
      STOP
      END.
```

Work/Title

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D.2.19 Cooling Load Calculations by Conventional Means

D.2.20 Selection of Operational Equipment

COMPUTATION SHEET — 5mm SQUARES

ROOM-LOUNGE

ITEM	AREA OR QTY	SUN GAIN OR TEMP. DIFF.	FACTORS	LOAD WATTS
SENSIBLE				
GLASS(N)	2·8 M²	320W	0·14	125·4
WALL(N)	10·2 M²	12·2°C	0·76	94·6
WALL(E)	17·0 M²	12·8°C	0·94	204·5
ROOF	20·0 M²	20·6°C	1·32	543·8
PEOPLE	7	60·0W	0·6	252·0
LIGHT	20·0 M²	25·0 W/M²	0·8	400·0
GLASS (TRANSIENT)	2·8 M²	10·5°C	5·89	173·2
		ROOM SENSIBLE HEAT		1793·3
LATENT				
PEOPLE	7	40·0W	0·4	112·0
		ROOM LATENT HEAT		112·0
		ROOM TOTAL HEAT		1905·3

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COMPUTATION SHEET — 5mm SQUARES

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ROOM - DINING

ITEM	AREA OR QTY	SUN GAIN OR TEMP. DIFF.	FACTORS	LOAD WATTS
SENSIBLE				
GLASS (E)	2·4 M²	550W	0·14	184·8
WALL (E)	12·8 M²	12·8°C	0·94	154·0
WALL (PART)	15·6 M²	10·5°C	1·88	307·9
ROOF	19·0 M²	20·6°C	1·32	516·6
PEOPLE	5	60W	0·6	180·0
LIGHT	19·0 M²	25 W/M²	0·8	380·0
GLASS (TRANSIENT)	2·4 M²	10·5°C	5·89	148·4
	ROOM SENSIBLE HEAT			1871·7
LATENT				
PEOPLE	5	40W	0·4	80·0
	ROOM LATENT HEAT			80·0
	ROOM TOTAL HEAT			1951·7

PART - PARTITION

Work/Title	Sheet Number
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COMPUTATION SHEET — 5mm SQUARES

ROOM - BEDROOM NO. 1

ITEM	AREA OR QTY	SUN GAIN OR TEMP. DIFF.	FACTORS.	LOAD WATTS
SENSIBLE				
GLASS(N)	2·2M²	320W	0·14	98·5
WALL(N)	15·3M²	12·2°C	0·76	141·9
WALL(W)	15·4M²	7·8°C	1·12	134·5
WALL(E)	10·0M²	12·8°C	0·94	120·3
ROOF	24·0M²	20·6°C	1·32	652·6
PEOPLE	2	60·0W	0·6	72·0
LIGHT	24·0M²	25·0W/M²	0·8	480·0
GLASS (TRANSIENT)	2·2M²	10·5°C	5·89	136·0
	ROOM SENSIBLE HEAT			1835·8
LATENT				
PEOPLE	5	40·0W	0·4	80·0
	ROOM LATENT HEAT			80·0
	ROOM TOTAL HEAT			1915·8

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COMPUTATION SHEET — 5mm SQUARES

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ROOM - BEDROOM NO. 2

ITEM	AREA OR QTY	SUN GAIN OR TEMP. DIFF.	FACTORS	LOAD WATTS
SENSIBLE				
GLASS(W)	3·9 M²	550W	0·14	300·3
WALL(W)	11·5M²	7·8°C	1·12	100·5
ROOF	22·5 M²	20·6°C	1·32	611·8
PEOPLE	2	60W	0·6	72·0
LIGHT	22·5M²	25W/M²	0·8	450·0
GLASS (TRANSIENT)	3·9 M²	10·5°C	5·89	241·2
	ROOM SENSIBLE HEAT			1775·8
LATENT	2	40W	0·4	32·0
	ROOM LATENT HEAT			32·0
	ROOM TOTAL HEAT			1807·8

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COMPUTATION SHEET — 5mm SQUARES

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ROOM-BEDROOM NO. 2

ITEM	AREA OR QTY	SUN GAIN OR TEMP. DIFF.	FACTORS	LOAD WATTS
SENSIBLE				
GLASS(W)	1·7 M²	550W	0·14	130·9
WALL (W)	5·8 M²	7·8°C	1·12	50·7
WALL (PARTITION)	22·8 M²	10·5°C	1·88	450·0
ROOF	17·5 M²	20·6°C	1·32	475·9
PEOPLE	1	60	0·6	36·0
LIGHT	17·5M²	25W/M²	0·8	350·0
GLASS (TRANSIENT)	1·7M²	10·5°C	5·89	105·1
	ROOM SENSIBLE HEAT			1598·6
LATENT	1	40	0·4	16·0
	ROOM LATENT HEAT			16·0
	ROOM TOTAL HEAT			1614·6

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COMPUTATION SHEET — 5mm SQUARES

TOTAL ENERGY GAIN

ROOM	SENSIBLE WATTS	LATENT WATTS	TOTAL WATTS
LOUNGE	1793	112	1905
DINING	1872	80	1952
BEDROOM NO. 1	1836	80	1916
BEDROOM NO. 2	1776	32	1808
BEDROOM NO. 3	1599	16	1615
	8876	320	9196

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COMPUTATION SHEET — 5mm SQUARES

SELECTION OF OPERATIONAL EQUIPMENT

	WATTS
• ROOM SENSIBLE ENERGY	8876
• FRESH AIR 94×10·5×1·2×0·25	296
• EFFECTIVE ROOM SENSIBLE ENERGY	9172
• ROOM LATENT ENERGY	320
• INFILTRATION OF STEAM FROM KITCHEN & BATHROOM	340
• FRESH AIR 94×1·8×3×0·25	127
• EFFECTIVE ROOM LATENT ENERGY	787
• EFFECTIVE ROOM TOTAL ENERGY	9959
• FRESH AIR 94×10·5×1·2×0·75	888
• FRESH AIR 94×1·8×3×0·75	381
• SUPPLY AIR FAN FOR BLOW-THRU SYSTEM	500
TOTAL ENERGY	11828

PREDICTED BY-PASS FACTOR OF CONVENTIONAL ENERGY EXCHANGER - - - - - - - - - 0·25

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• EFFECTIVE SENSIBLE ENERGY FACTOR ... ... $\frac{9172}{9959}$

$= 0.92$

• APPARATUS DEW POINT FROM ESHF ... ... 12·2°C

• EFFECTIVE ROOM SENSIBLE HEAT FACTOR ... ...

$\frac{8876}{8876+660}$

$= \frac{8876}{9536}$

$= 0.93$

• GRAND SENSIBLE HEAT FACTOR ...

$\frac{9172+888+500}{11828}$

$= \frac{10560}{11828} = 0.90$

• SELECTED APPARATUS DEW POINT

10·5°C

TO MINIMISE FAN HORSEPOWER, BEARING IN PRINCIPLE THAT THE RELATIVE HUMIDITY WILL BE MAINTAINED WITHIN THE SPECIFIED TOLERANCES.

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DRY BULB ... ...

A.D.P + BF(AIR ON-A.D.P)

$= 10·5 + 0·25(27·02 - 10·5)$

$= 10·5 + 0·25 \times 16·52 \quad = 10·5 + 4·13$

$= 14·63$ °CD.B

CHECK SENSIBLE ENERGY BALANCE

$680 \times 1·2 \times (27·02 - 14·63)$

$= 10110$ WATTS

AGAINST 10560 WATTS

LATENT ENERGY EXCHANGE

"AIR ON" CONDITIONS FOR ENERGY EXCHANGERS

LATENT ENERGY EXCHANGE

MOISTURE CONTENT

$\frac{586}{680} \times 8·1 + \frac{94}{680} \times 9·9 = 6·98 + 1·37$

$= 8·35$ gm/Kgm of dry air.

"AIR OFF" CONDITIONS FOR ENERGY EXCHANGERS

LATENT ENERGY EXCHANGE

MOISTURE CONTENT

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FROM PSYCHROMATIC CHART,

7·78 gm/Kgm of dry air.

CHECK LATENT ENERGY BALANCE

$680 \times 3 \times (8·35 - 7·78)$

= 1162 WATTS AGAINST 1168 WATTS.

SUMMARY OF COOLING PEAK LOAD CONDITIONS

AIR ON

– 27·02°C D.B 8·35 $\frac{\text{gm}}{\text{Kgm. of dry air}}$

AIR OFF

– 14·63°C D.B 7·78 $\frac{\text{gm}}{\text{Kgm of dry air}}$

AMBIENT CONDITIONS

DRY BULB – 36°C DB

WET BULB – 21°C WB

— o — o —

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D.2.21 Heating Load Calculations by Conventional Means

COMPUTATION SHEET — 5mm SQUARES

41

MAXIMUM HEATING LOAD CALCULATIONS

WINTER DESIGN CONDITIONS

3·5°C D.B. 80% R.H.

ROOM - LOUNGE

ITEM	AREA OR QTY M²	TEMP. DIFF. °C	FACTORS.	ENERGY LOSS WATTS
GLASS	2·8	17·5	6·03	295·4
WALLS	27·2	17·5	1·88	899·6
ROOF	20·0	17·5	1·89	661·5
				1856·5

ROOM - DINING

GLASS	2·4	17·5	6·03	253·2
WALLS	29·4	17·5	1·88	967·3
ROOF	19·0	17·5	1·89	628·4
				1848·9

BEDROOM NO. 1

GLASS	2·2	17·5	6·03	232·2
WALLS	40·7	17·5	1·88	1339·0
ROOF	24	17·5	1·89	793·8
				2365·0

BEDROOM NO. 2

GLASS	3·9	17·5	6·03	411·5
WALLS	11·5	17·5	1·88	378·4
ROOF	22·5	17·5	1·89	744·2
				4534·1

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COMPUTATION SHEET — 5mm SQUARES

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ROOM - BEDROOM NO. 3

ITEM	AREA OR QTY M^2	TEMP. DIFF. °C	FACTORS	ENERGY LOSS WATTS
GLASS	1·7	17·5	6·03	179·4
WALLS	28·6	17·5	1·88	940·9
ROOF	17·5	17·5	1·89	578·8
				1699·1

ROOM SENSIBLE ENERGY EXCHANGES

LOUNGE	...	1857
DINING	...	1849
BEDROOM NO. 1	...	2365
2	...	1534
3	...	1699
		9304

F/A ENERGY EXCHANGE, SENSIBLE

$94 \times 1{\cdot}2 \times 17{\cdot}5 =$ 1974 WATTS

∴ REQUIRED SENSIBLE ENERGY EXCHANGE

$= 9304 + 1974 = 11278$ WATTS.

LATENT ENERGY EXCHANGE

F/A $94 \times 3 \times 4{\cdot}7 =$ 1325 WATTS.

LATENT ENERGY LOSS THROUGH THE SYSTEM = 467 WATTS

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COMPUTATION SHEET — 5mm SQUARES

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TOTAL LATENT ENERGY EXCHANGE

1325	WATTS
467	WATTS
1792	WATTS

SUMMARY OF HEATING PEAK LOAD CONDITIONS

SENSIBLE ...	11278 WATTS
LATENT	1792 WATTS

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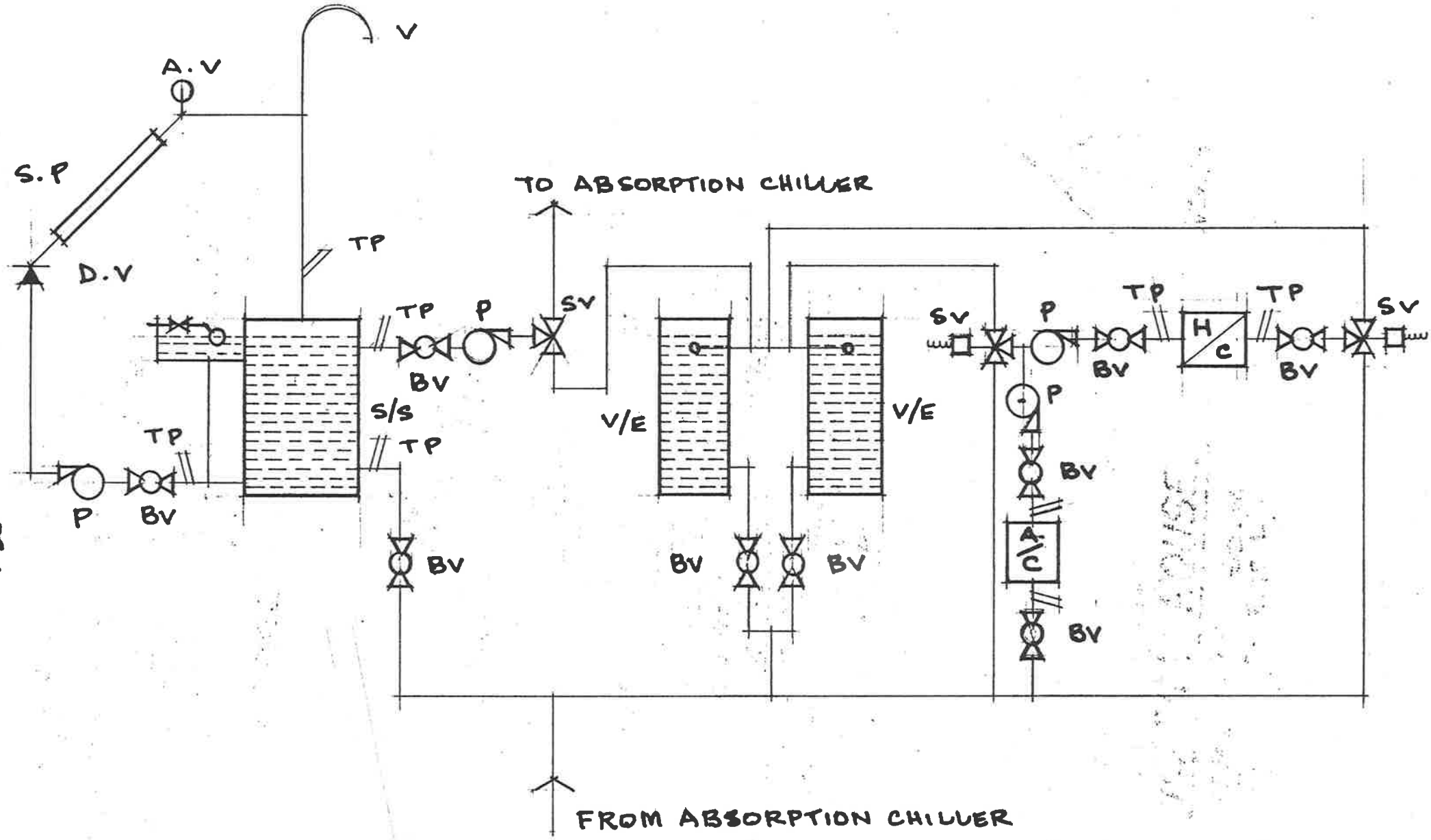
D ~~E~~.

SKETCHES AND DRAWINGS

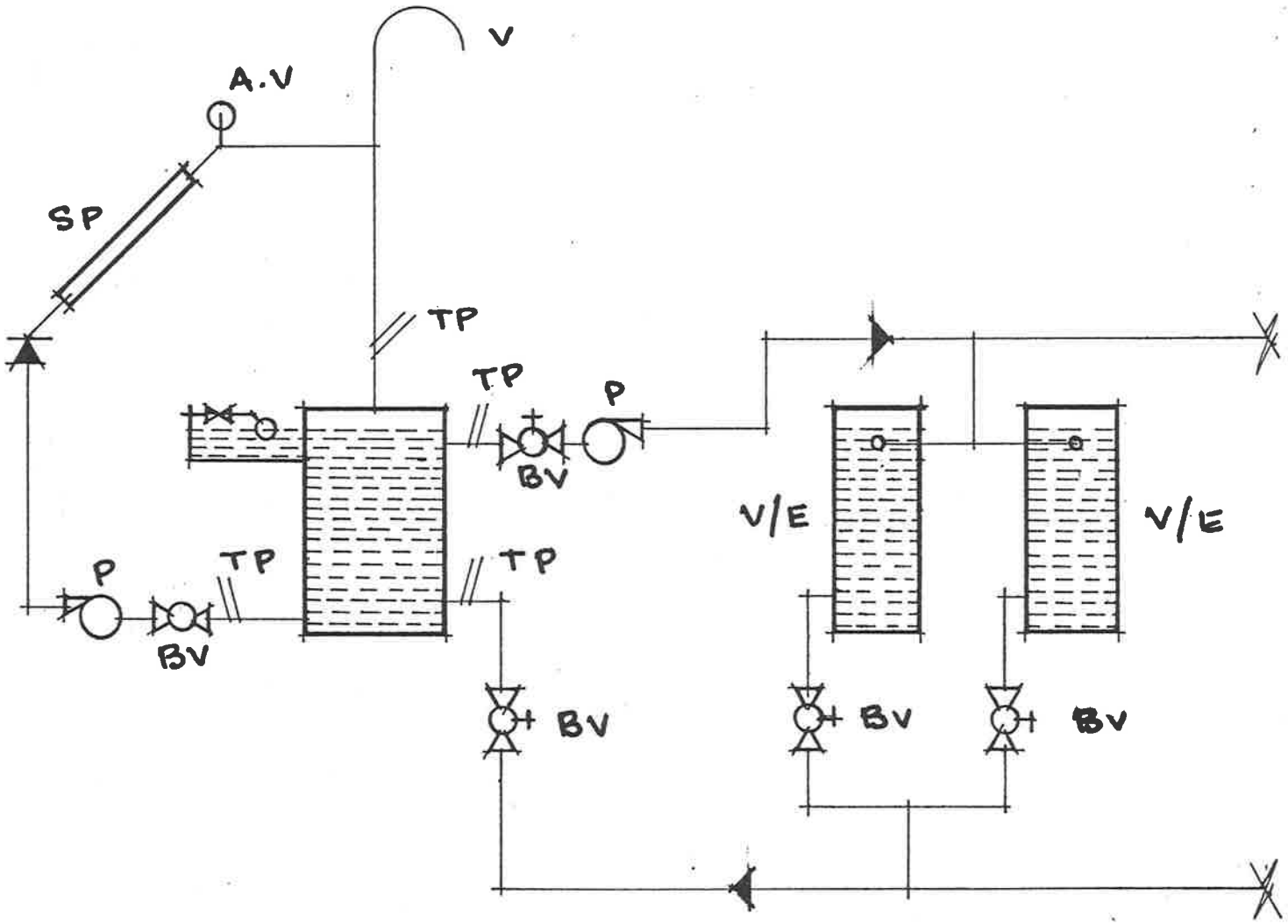
SYMBOLS

H.C	---	HERMETIC COMPRESSOR
B.V	---	BUTTERFLY VALVE
A.C	---	ABSORPTION CHILLER
V.E	---	ENERGY STORAGE VESSELS/ EXCHANGERS
P	---	PUMP
D.V	---	DIRECTIONAL VALVE
T.	---	THERMOMETER POCKETS
S	---	SOLAR HOT WATER CYLINDER
S.P	---	SOLAR PANELS
V	---	NATURAL VENT
A.V	---	AUTOMATIC VENT



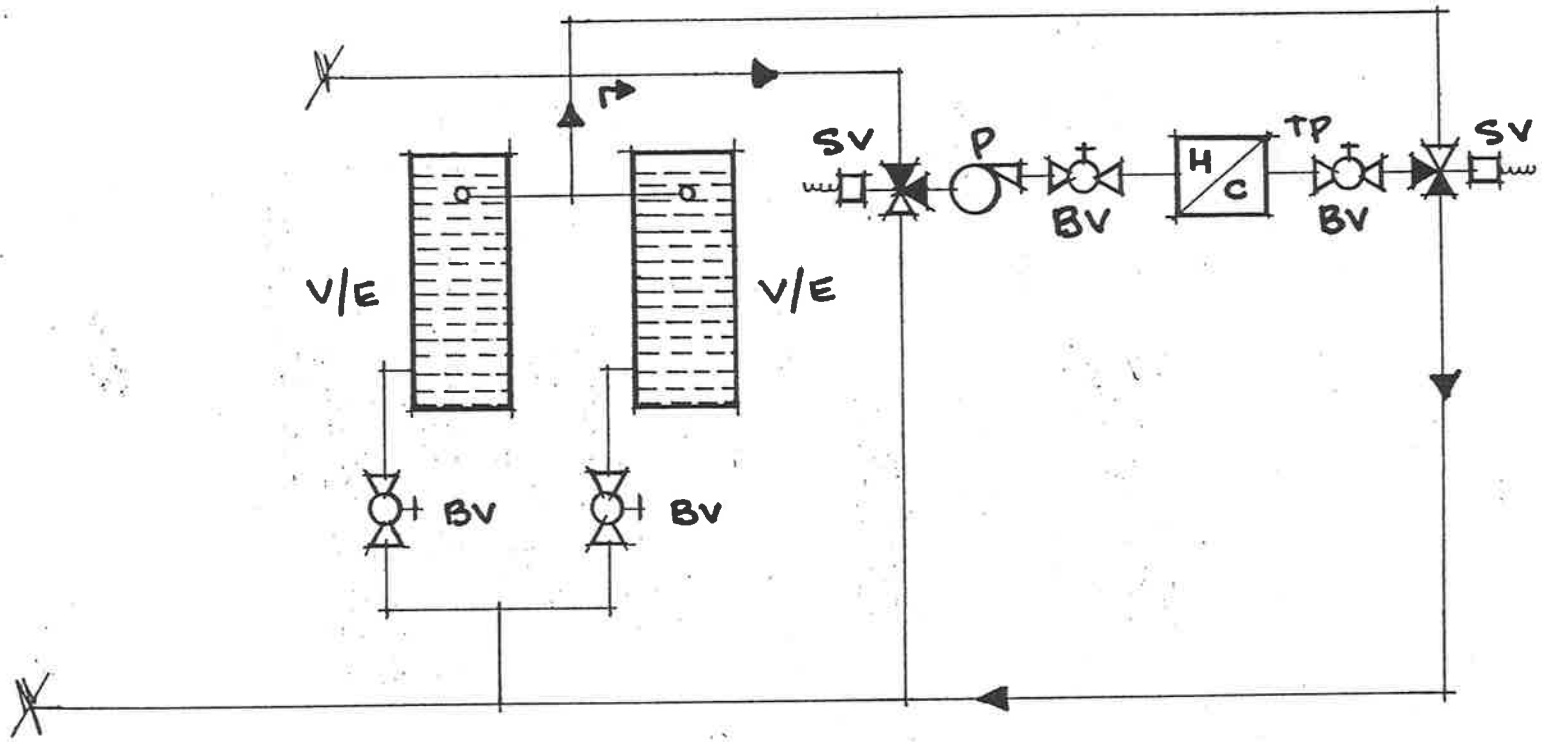
7.2

TOTAL SYSTEM CIRCUIT

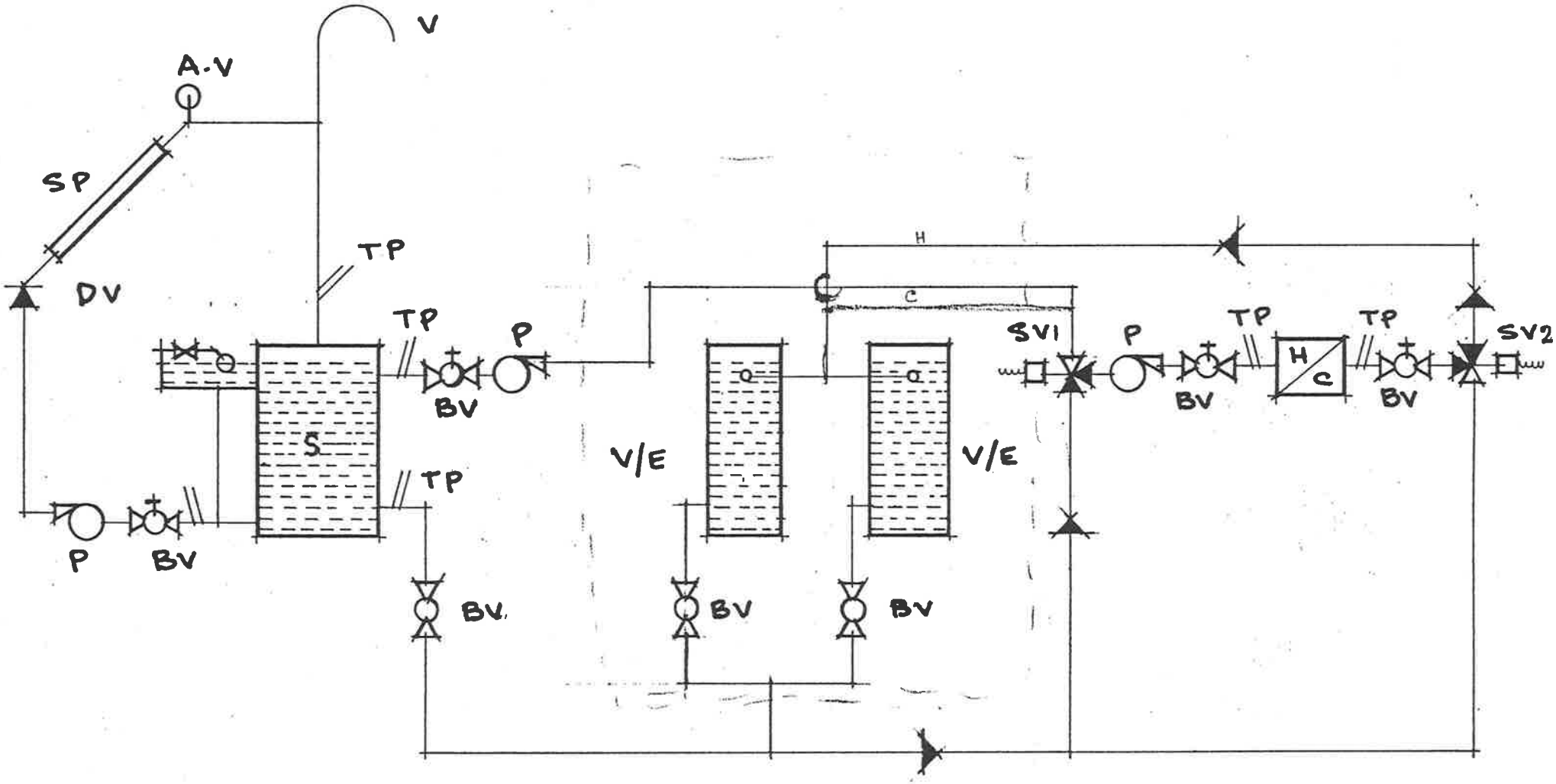


7.3

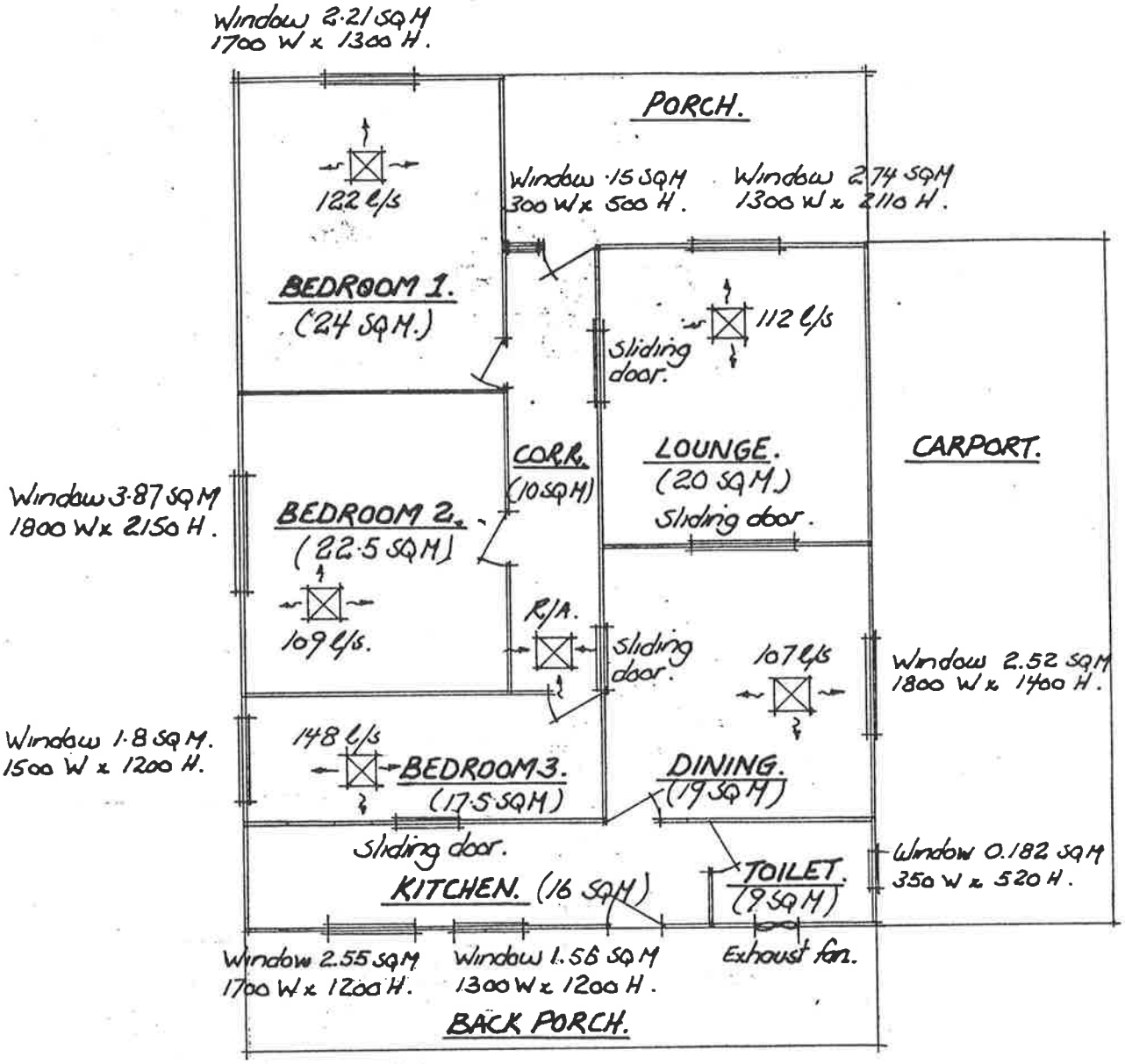
SOLAR HEATING CYCLE



AUXILIARY COOLING CYCLE

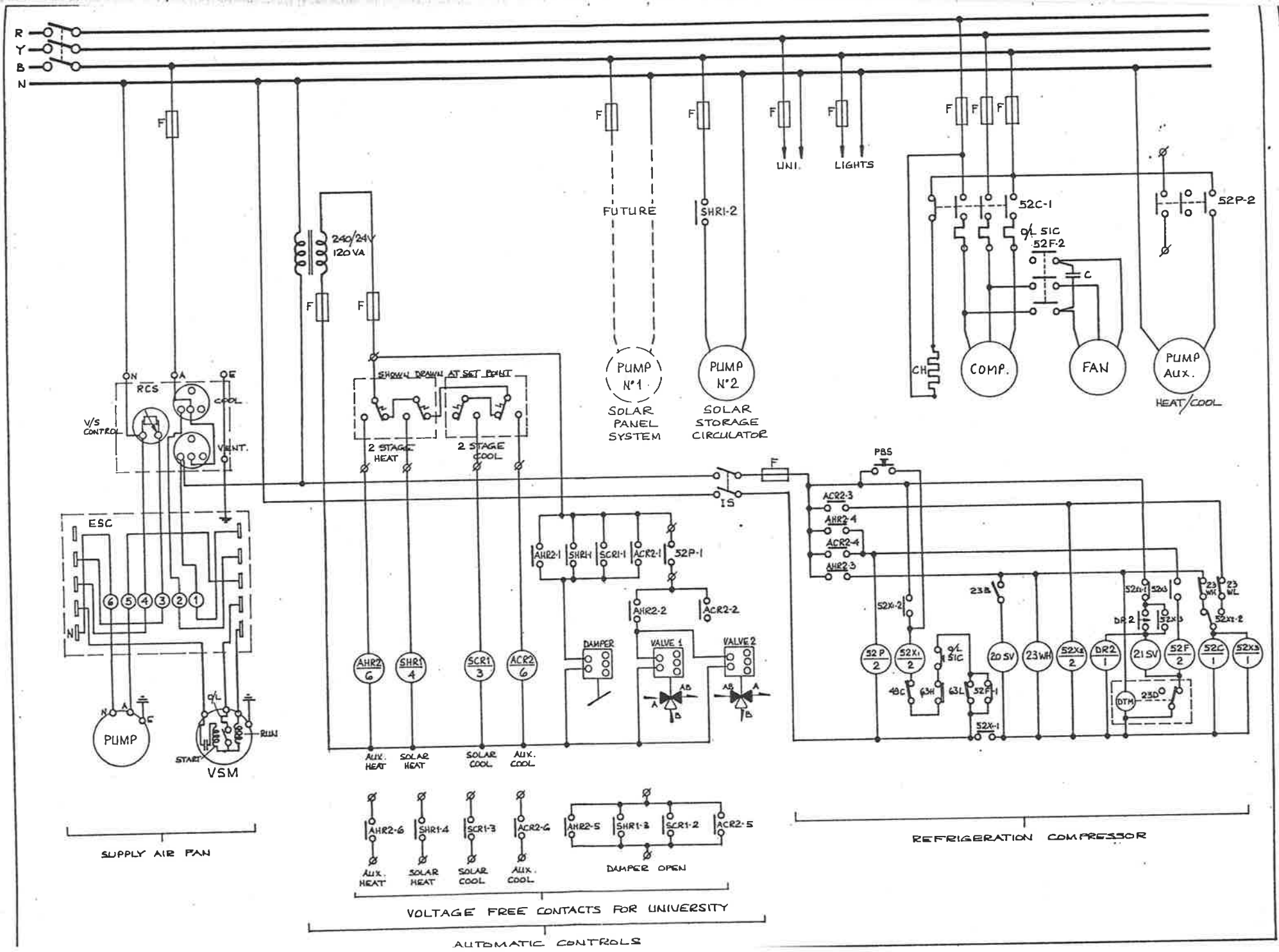


S.T.



MAGILL HOUSE.

AREAS 103 SQ.M.
AIR QUANTIES. 598 L/S


R
Y
B
N
F
240/24V
120VA
FUTURE
SHR1-2
UNI.
LIGHTS
52C-1
52P-2
o/L SIC
52F-2
C
CH
COMP.
FAN
PUMP Aux.
HEAT/COOL
PUMP N°1
SOLAR PANEL SYSTEM
PUMP N°2
SOLAR STORAGE CIRCULATOR
SHOWN DRAWN AT SET POINT
2 STAGE HEAT
2 STAGE COOL
RCS
COOL
VENT.
V/S CONTROL
ESC
IS
PBS
AHR2-1
SHR1
SCR1-1
ACR2-1
52P-1
AHR2-2
ACR2-2
AHR2-3
ACR2-3
AHR2-4
ACR2-4
DAMPER
VALVE 1
VALVE 2
AHR2 6
SHR1 4
SCR1 3
ACR2 6
PUMP
VSM
START
RUN
o/L
AUX. HEAT
SOLAR HEAT
SOLAR COOL
AUX. COOL
AHR2-6
SHR1-4
SCR1-3
ACR2-6
AHR2-5
SHR1-3
SCR1-2
ACR2-5
DAMPER OPEN
VOLTAGE FREE CONTACTS FOR UNIVERSITY
AUTOMATIC CONTROLS
SUPPLY AIR FAN
REFRIGERATION COMPRESSOR
52X-2
52X-1
23B
20 SV
23WH
52X2 2
DR2 1
21 SV
52F 2
52C 1
52X3 1
23 WH
23 WL
52X1-2
52X3
DR2
49C
63H
63L
52F-1
DTM
23D
32P 2
52X1 2